MALTA REVIEW OF EDUCATIONAL RESEARCH

Volume 18, No. 2, 388-412
Faculty of Education©, UM, 2024

Using lesson study to implement the CPA approach in a Mathematics primary classroom

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Abstract: Throughout their career, several teachers seek to improve their professional practice through various means. Lesson study, a collaborative approach to teacher professional development, involves educators working together over an extended period of time to improve teaching and learning. The cyclical process involves identifying a learning goal, preparing a lesson plan, implementing the lesson, reflecting on student learning and revising the lesson plan. This article illustrates the process of a lesson study which was implemented in a local state primary school. This lesson study, conducted as part of the Master of Arts in Educational Leadership and Management course at the University of Malta, focused on teaching mathematics through the concrete-pictorial-abstract (CPA) approach.

Keywords: CPA; lesson study; mathematics; primary education; professional development

Introduction

Lesson study has been described as an opportunity for teachers to "learn together about what constitutes effective teaching and to share that knowledge with other educators" (Bartalo, 2012, p. 3). Briefly, lesson study seems to empower teachers to be responsible for their own learning, a skill that we also

aim for our students to master. Through lesson study, teachers engage in conversations about teaching and learning and seek ways of improving their classroom practices.

The process involves selecting a team and holding a series of meetings to: (1) select a goal, which is derived from identifying a specific problem in pedagogical practice; (2) conducting research on the selected goal; (3) drawing up a detailed lesson plan and devising an observation (data collection) sheet that outlines the key phases of the lesson; (4) teaching the lesson and collecting data through observers; and (5) holding a post-lesson discussion to evaluate outcomes and seek improvements.

A common practice in lesson study involves inviting an advisor, also referred to as knowledgeable other, to key meetings to observe, give feedback and enrich the work of the lesson study group (Fernandez, 2022). The research lesson is often delivered by a team member while the rest of the team completes the observation sheet by closely monitoring the involvement and learning process of assigned students. This is followed by a post-lesson discussion where the teacher and observers reflect and critically evaluate the lesson to formulate a revised version of the lesson plan (Rock and Wilson, 2005). The research lesson may be delivered to different groups of students so that the cycle can be repeated as many times as needed. As in my case, at the end of the process, a lesson study report is produced and disseminated to allow other teachers to learn from each other (Fernandez, 2022). Despite being a lengthy process, Stigler and Hiebert (1999) claim that lesson study leads to gradual improvements in teaching and learning and, thus, contributes to teacher professional development.

The lesson study presented in this report formed part of the work produced in an elective study unit within the MA in Educational Leadership and Management programme which I, the first author, am currently pursuing. Hence, my role in this lesson study was to lead the process with teachers. This involved selecting the team members, setting and facilitating meetings, taking care of logistics, and maintaining ongoing communication with the lesson study team and the school leadership team (SLT).

The research lesson

The school development plan (SDP) stipulates that the concrete-pictorial-abstract (CPA) approach is to be implemented to facilitate the teaching of

mathematical concepts and to scaffold student learning. According to Salimi et al. (2020, p.), CPA offers

> a significant learning approach to teach mathematical concepts by actively involving students in exploration activities such as practising, demonstrating and manipulating teaching aids that are appropriate to the stage of student development so that students can construct their meanings and understandings (p.2)

The Year 3 group of teachers, which I form part of, find this to be one of our main challenges. Indeed, very often our students struggle with concepts presented in an abstract way. When the lesson study process was presented to the Year 3 teachers it was agreed that lesson study could serve as a means through which we could attempt to address this issue.

The aim of our lesson study was to observe our Year 3 students while they engaged in activities, using concrete resources, pictorial representations and abstract concepts, related to the learning outcome being addressed. We selected learning outcome 5.6.2: "I can read and write the vocabulary related to position, direction (clockwise and anticlockwise) and movement" (Directorate for Quality and Standards in Education, 2015, p. 20), as the focus of the lesson. The lesson was planned in such a way that students were engaged in scaffolded activities that exposed them to this learning outcome, while conforming with the principles of the CPA approach (see Figure 1). Following a small group work activity, where students had to discuss a concept cartoon and come up with a set of instructions for walking in a square, the abstract concept was consolidated in the *neriage* phase, that is, the concluding part of the lesson. During this phase, students presented their findings, and the teacher orchestrated a discussion around students' findings and presentations (Fuji, 2016).

The evidence of the learning that took place was gathered, based on the students' participation or lack thereof. The key points noted by the observers during the delivery of the lesson, were brought up during the post-lesson discussion, which gave us insight to the stages where the students struggled most. This stimulated the discussion further to determine the way the lesson plan could be improved to facilitate student learning.

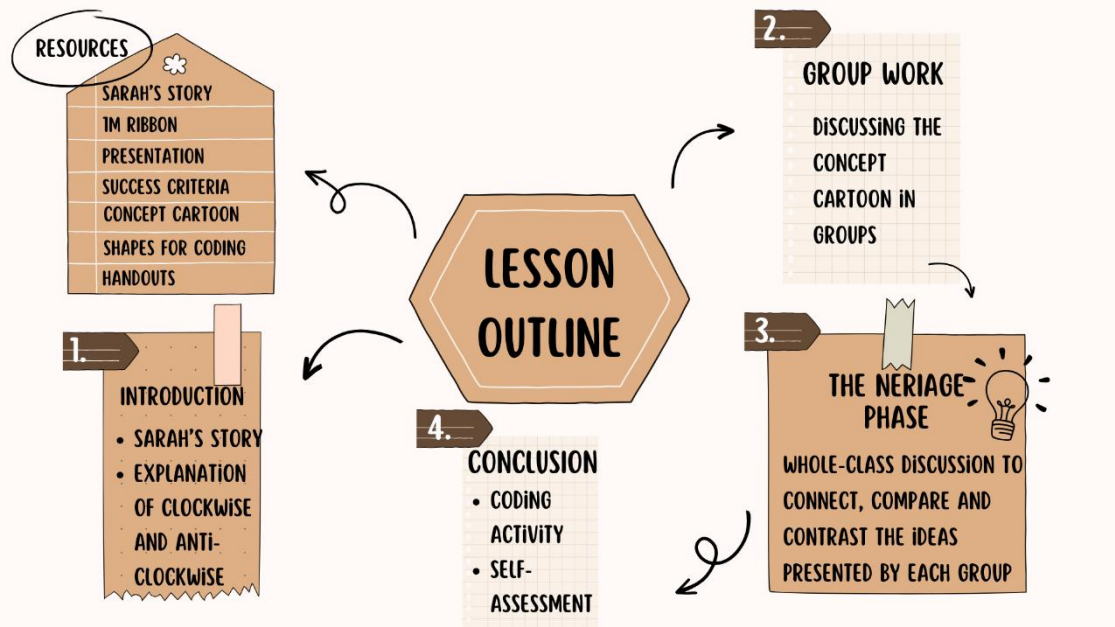


Figure 1: Outline of the research lesson

The lesson study context

Birkirkara primary school is one of the largest state schools in Malta, in terms of school population and number of classes. The Year 3 cohort comprised seven classes of around 15 students each. In this Year 3 group, each class was assigned two learning support educators (LSEs) who assisted students with a statement of needs, as well as other students who encountered learning difficulties during lessons.

Our lesson study team consisted of two Year 3 teachers, the year group assistant head and the mathematics support teacher who took the role of advisor. All members of the team worked at the school, and it was agreed that the lesson would be delivered to the classes taught by both Year 3 teachers. This facilitated the logistical organisation as well as the lesson planning, since we knew the students and we were conscious of their strengths and learning needs.

The lesson study was supervised by James Calleja and Laura Formosa, who guided the process through lectures and individual support, at the University of Malta. When I taught the lesson to my class, the lesson study team members, both class LSEs and James observed the class and noted key ideas on an observation sheet.

The lesson study process

The first stage of the process involved identifying team members who were willing to participate in this lesson study. Team members were carefully selected, considering aspects such as: similarities in our teaching philosophy; teaching experience; and communication and flexibility. While lesson study is beneficial and promotes teacher learning in an authentic context, it is a time-consuming exercise and requires commitment from all members. Selecting a colleague working in Year 3 and our year group assistant head facilitated logistical arrangements for our weekly meetings. Furthermore, Stepanek et al. (2009) suggest that lesson study is likely to take off quicker when educators are already accustomed to working together. The team members were approached individually during break and the process and benefits of lesson study were outlined. Knowing that the team members had a very busy schedule, they were reassured that most of the work would be carried out during school hours and that the timeline of the process would be addressed in the first meeting.

During the initial meeting, we selected a focus for the lesson study and one learning outcome. It was agreed that we would seek advice from the mathematics support teacher assigned to our school. A timeline was also drafted to allow us to adjust the mathematics scheme of work so that the learning outcomes related to direction were covered during the week when the lesson delivery was planned to take place. In addition, an online group chat was created on MS Teams. This maintained our ongoing communication from one meeting to the next.

The next phase of the process revolved around the planning of the lesson. The team first reflected on the lesson objective and then suggested a range of possible activities which could present the concept using concrete, pictorial and abstract representations. During the next meetings, further discussions took place and, once we agreed on a possible design, the lesson plan was drafted. This lesson plan was forwarded to the mathematics support teacher through the group chat. Upon review, she suggested ways and provided resources meant to enhance the lesson, to better support student learning. The lesson plan was revised, and the final version was completed. An observation sheet was then created, and two students were assigned to each observer. Hard copies of the lesson plan and the observation sheet were handed out to the observers prior to the lesson.

As agreed during the meetings, the lesson was delivered first to my Year 3 class. At the beginning of the school day, the students were informed that the class would have guest educators during the mathematics lesson. As the students were familiar with most members of the team, they seemed to be comfortable having attendees in their class. In fact, notwithstanding this uncommon situation, students participated actively during the lesson.

During the post-lesson discussion, a most important phase of the lesson study process, all the observers drew on data that they had collected during the lesson. They shared their reflections, mentioning both the positive aspects of the lesson and areas for improvement. Next, team members reflected on this feedback and the process was finalised with a revised version of the lesson plan, which was distributed to the team and to colleagues who showed interest in lesson study.

Key instructional decisions within the research lesson

The learning objective of the research lesson, derived from learning outcome 5.6.2, stated that students would be able to name the direction of a turn and to rotate a ribbon in clockwise or anticlockwise motion, as instructed. Furthermore, adhering to the principles of lesson study, student learning was extended while they were prompted to come up with a set of instructions for walking in a square.

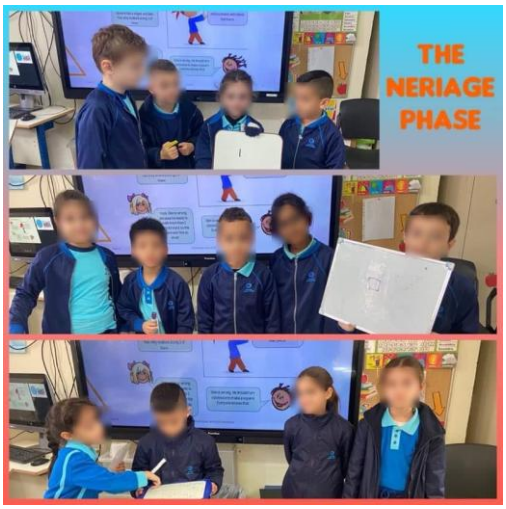
The research lesson was initiated by putting the topic in context, through a story-telling activity. The story presented a challenge that involved rotating a ribbon in clockwise and anticlockwise motion. This allowed the teacher and the observers to assess prior knowledge. Since this was the first lesson on the topic a short explanation, which called for students' active participation, was needed. The core activity of the lesson involved a task where students discussed the statements, presented on a concept cartoon, working in small groups. The groups were pre-set in such a way that at least one student in each group was a fluent reader. Students' mathematical abilities, personalities and performance in previous group work tasks were also considered when assigning groups. The activity was followed by presentations of the solutions put forward by group. As a concluding activity, students were asked to place several shapes in order, to create a code which includes clockwise and anticlockwise spins.

The evidence compiled from the observation informed the team that most students had reached the main objectives when supported with concrete or pictorial representations. However, they struggled with the abstract concept, especially in the *neriage* phase of the lesson. The support needed involved giving a second explanation, and using short, specific instructions and examples, to each group separately. This form of scaffolding was needed throughout the activity and during students' presentations.

At the end of the research lesson, students were given a self-assessment card, encouraging them to reflect on the lesson and their learning. Students' responses presented the team with a better picture of what students could achieve and what they struggled most with.

Highlights documenting the lesson study process

In the samples presented below there is a set of photos documenting the lesson study process. In addition, there are self-evaluation cards and observation sheets that served as evidence of student learning and areas for improvement.



Activity 1: Story Starter

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Listens attentively to the story.	Yes	Listened attentively	Listens attentively to the story.	Yes	Listened attentively
Attempts to answer the questions being asked.	No	Never answered it's questions	Attempts to answer the questions being asked.	No	Never answered it's questions
Demonstrates the ability to follow the sequence.	Yes	Followed it's instructions and remembered the pattern	Demonstrates the ability to follow the sequence.	Yes	Followed it's instructions and remembered the pattern. or copied her classmates

Activity 2: Lesson explanation

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Listens attentively to the explanation.	Yes	Followed instructions given	Listens attentively to the explanation.	Yes	Followed instructions given
Understands that clockwise and anticlockwise show different directions.	Yes	used the ribbon correctly	Understands that clockwise and anticlockwise show different directions.	Yes	used the ribbon correctly
Demonstrates the ability to follow the sequence.	Yes	done it independently without prompting	Demonstrates the ability to follow the sequence.	Yes	done it independently without prompting.

Activity 3: Group work

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Expresses agreement or disagreement with at least one of the statements in the concept cartoon.	Yes	chose the correct statement	Expresses agreement or disagreement with at least one of the statements in the concept cartoon.	Yes	chose the correct statement but not sure whether she copied her class mate.
Uses the terms 'clockwise' and	No	Sometimes he confused the	Uses the terms 'clockwise' and	No	No feedback given

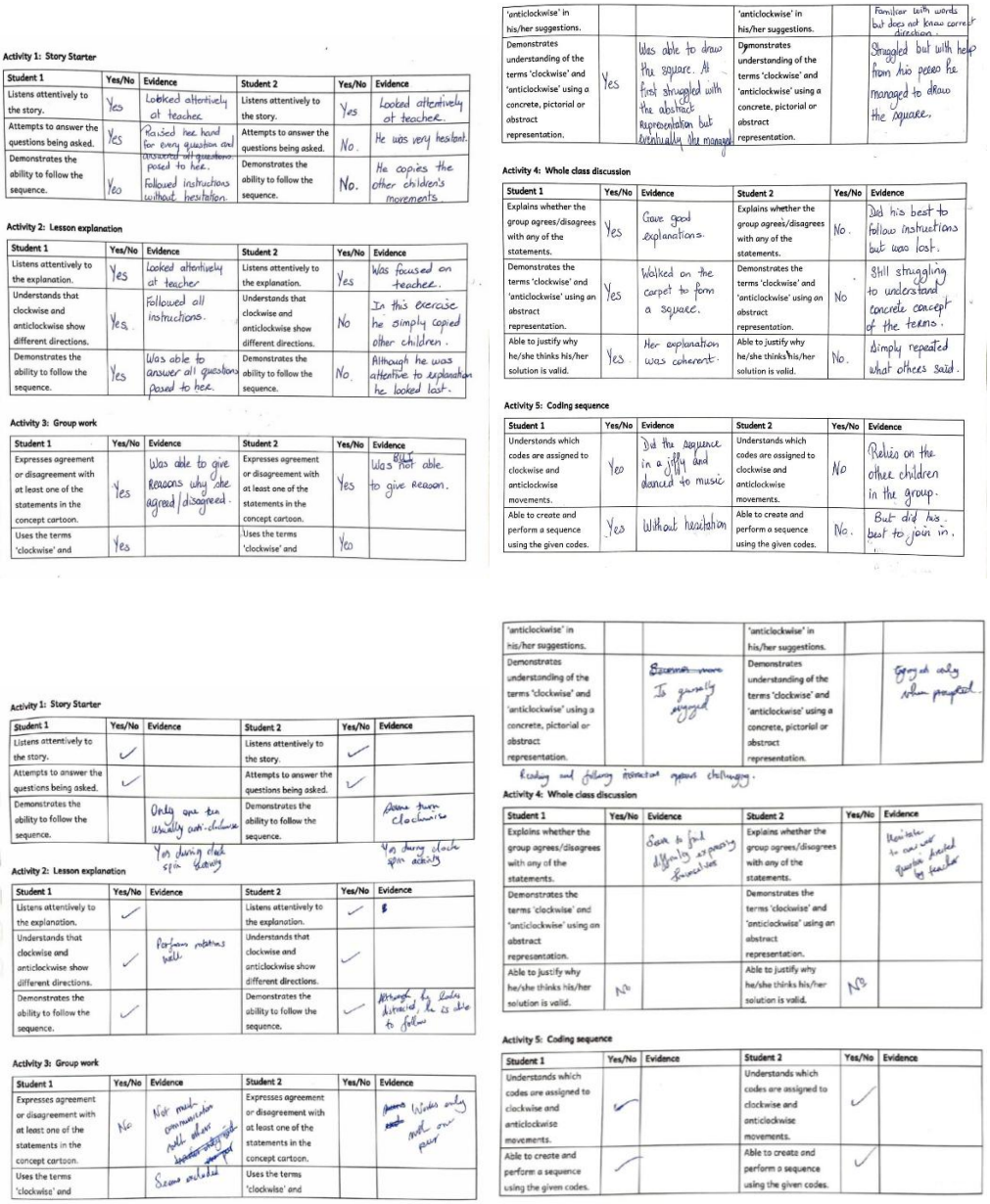
'anticlockwise' in his/her suggestions.	Yes	anticlockwise turn	'anticlockwise' in his/her suggestions.		
Demonstrates understanding of the terms 'clockwise' and 'anticlockwise' using a concrete, pictorial or abstract representation.	Yes	Pictorial representation on personal whiteboard	Demonstrates understanding of the terms 'clockwise' and 'anticlockwise' using a concrete, pictorial or abstract representation.	No	Did not attempt to show working or explain why.

Activity 4: Whole class discussion

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Explains whether the group agrees/disagrees with any of the statements.	Yes	listed names on the whiteboard	Explains whether the group agrees/disagrees with any of the statements.	No	No discussion from her end.
Demonstrates the terms 'clockwise' and 'anticlockwise' using an abstract representation.	Yes	Drew on the whiteboard	Demonstrates the terms 'clockwise' and 'anticlockwise' using an abstract representation.	No	No response
Able to justify why he/she thinks his/her solution is valid.	Yes	Justified his reasoning	Able to justify why he/she thinks his/her solution is valid.	No	remained silent

Activity 5: Coding sequence

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Understands which codes are assigned to clockwise and anticlockwise movements.	Yes	followed the pattern correctly	Understands which codes are assigned to clockwise and anticlockwise movements.	Yes	followed the pattern correctly
Able to create and perform a sequence using the given codes.	Yes	Done it correct repeatedly	Able to create and perform a sequence using the given codes.	Yes	Done it correct repeatedly.



Activity 1: Story Starter

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Listens attentively to the story.	Yes	Looked attentively at teacher.	Listens attentively to the story.	Yes	Looked attentively at teacher.
Attempts to answer the questions being asked.	Yes	Raised her hand for every question and answered all questions posed to her.	Attempts to answer the questions being asked.	No.	He was very hesitant.
Demonstrates the ability to follow the sequence.	Yes	Followed instructions without hesitation.	Demonstrates the ability to follow the sequence.	No.	He copies the other children's movements.

Activity 2: Lesson explanation

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Listens attentively to the explanation.	Yes	Looked attentively at teacher.	Listens attentively to the explanation.	Yes	Was focused on teacher.
Understands that clockwise and anticlockwise show different directions.	Yes.	Followed all instructions.	Understands that clockwise and anticlockwise show different directions.	No	In this exercise he simply copied other children.
Demonstrates the ability to follow the sequence.	Yes	Was able to answer all questions posed to her.	Demonstrates the ability to follow the sequence.	No.	Although he was attentive to explanation he looked lost.

Activity 3: Group work

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Expresses agreement or disagreement with at least one of the statements in the concept cartoon.	Yes	Was able to give reasons why she agreed/disagreed.	Expresses agreement or disagreement with at least one of the statements in the concept cartoon.	Yes	Was not able to give reason.
Uses the terms 'clockwise' and 'anticlockwise' in his/her suggestions.	Yes		Uses the terms 'clockwise' and 'anticlockwise' in his/her suggestions.	Yes	Familiar with words but does not know correct direction.
Demonstrates understanding of the terms 'clockwise' and 'anticlockwise' using a concrete, pictorial or abstract representation.	Yes	Was able to draw the square. At first struggled with the abstract representation but eventually she managed.	Demonstrates understanding of the terms 'clockwise' and 'anticlockwise' using a concrete, pictorial or abstract representation.		Struggled but with help from his peer he managed to draw the square.

Activity 4: Whole class discussion

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Explains whether the group agrees/disagrees with any of the statements.	Yes	Gave good explanations.	Explains whether the group agrees/disagrees with any of the statements.	No.	Did his best to follow instructions but was lost.
Demonstrates the terms 'clockwise' and 'anticlockwise' using an abstract representation.	Yes	Worked on the carpet to form a square.	Demonstrates the terms 'clockwise' and 'anticlockwise' using an abstract representation.	No	Still struggling to understand concrete concept of the terms.
Able to justify why he/she thinks his/her solution is valid.	Yes	Her explanation was coherent.	Able to justify why he/she thinks his/her solution is valid.	No.	Simply repeated what others said.

Activity 5: Coding sequence

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Understands which codes are assigned to clockwise and anticlockwise movements.	Yes	Did the sequence in a jiffy and danced to music	Understands which codes are assigned to clockwise and anticlockwise movements.	No	Relies on the other children in the group.
Able to create and perform a sequence using the given codes.	Yes	Without hesitation	Able to create and perform a sequence using the given codes.	No.	But did his best to join in.

Activity 1: Story Starter

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Listens attentively to the story.	✓		Listens attentively to the story.	✓	
Attempts to answer the questions being asked.	✓		Attempts to answer the questions being asked.	✓	
Demonstrates the ability to follow the sequence.		Only one in usually anti-clockwise	Demonstrates the ability to follow the sequence.		Knows them clockwise

Yes during class discussion

Yes during class discussion

Activity 2: Lesson explanation

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Listens attentively to the explanation.	✓		Listens attentively to the explanation.	✓	$
Understands that clockwise and anticlockwise show different directions.	✓	Performs rotations well.	Understands that clockwise and anticlockwise show different directions.	✓	
Demonstrates the ability to follow the sequence.	✓		Demonstrates the ability to follow the sequence.	✓	Although by looks distracted, he is able to follow

Activity 3: Group work

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Expresses agreement or disagreement with at least one of the statements in the concept cartoon.	No	Not much communication with others	Expresses agreement or disagreement with at least one of the statements in the concept cartoon.		Works only with one pair
Uses the terms 'clockwise' and 'anticlockwise' in his/her suggestions.		Seems excluded	Uses the terms 'clockwise' and 'anticlockwise' in his/her suggestions.		Enjoyed only when prompted.
Demonstrates understanding of the terms 'clockwise' and 'anticlockwise' using a concrete, pictorial or abstract representation.		Seems more Is generally engaged	Demonstrates understanding of the terms 'clockwise' and 'anticlockwise' using a concrete, pictorial or abstract representation.		

Reading and following instructions appears challenging.

Activity 4: Whole class discussion

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Explains whether the group agrees/disagrees with any of the statements.		Seem to find difficulty in providing explanations	Explains whether the group agrees/disagrees with any of the statements.		Hesitate to answer when posted by teacher
Demonstrates the terms 'clockwise' and 'anticlockwise' using an abstract representation.			Demonstrates the terms 'clockwise' and 'anticlockwise' using an abstract representation.		
Able to justify why he/she thinks his/her solution is valid.	No		Able to justify why he/she thinks his/her solution is valid.	No	

Activity 5: Coding sequence

Student 1	Yes/No	Evidence	Student 2	Yes/No	Evidence
Understands which codes are assigned to clockwise and anticlockwise movements.	✓		Understands which codes are assigned to clockwise and anticlockwise movements.	✓	
Able to create and perform a sequence using the given codes.	✓		Able to create and perform a sequence using the given codes.	✓	

Main takeaways from teaching the research lesson

Lesson study differs from other teacher professional development models in several ways. Lewis (2002) claims that lesson study stems from a question and professional development is driven by participants rather than by outsiders. Whereas more transmission type professional development is usually a one-sided talk delivered by a professional, lesson study is collaborative, teacher-led and encourages a flow of communication amongst participants. Reflecting on this experience of leading this lesson study, teacher learning was enhanced

through a practical approach that focused on a problem identified by teachers and a process driven by them through research. This authentic process was owned by the team from beginning to end. Moreover, team members noted that, throughout the different phases of the lesson study, the focus was on finding solutions together. This differs from other forms of top-down professional development where teachers are usually presented with solutions that are not tried and tested by teachers within their own school and classroom context.

Lenski and Caskey (2009) highlight that several research studies (e.g., Strangis et al. 2006, Sanchez & Valcarcel 1999) insist that many teachers rarely begin their planning by outlining the lesson objectives but rather by selecting the content knowledge or activities to include. In our daily lesson planning, it is easy for teachers to fall into this routine. However, the opportunity to collaboratively plan a research lesson draws teachers to draft clear learning objectives and stimulate them to keep these objectives in mind throughout each stage of the lesson study. The planning of the research lesson served as a reminder that the learning objectives are a core component of the lesson, and the chosen activities are deemed to be appropriate only if they serve as a vehicle to enable students to reach the set objectives.

Students benefitted from a carefully planned lesson based on the CPA approach which facilitated learning. The observers monitored student learning and provided further insight into the way the students learn, where they are struggling and how the teacher can help them achieve their learning goals. For instance, it was noted that some students seemed to be following the lesson, yet they did not participate during the group work activity. This prompted me to reflect on the reasons why students might hesitate to participate and measures I need to start taking. Was it because they were unmotivated, did not feel confident, struggled to understand what was asked of them, or was it because they did not know how to solve the problem? This served as an eye-opener for future lessons, as I made a conscious effort to ask these students questions directly, to check their understanding and, in more complex tasks, they started taking turns to explain the activity to the rest of the class.

Closing remarks

Lave and Wenger (1991) insist that learning is not the transmission of knowledge from one person to the next but rather a social process through which one co-constructs knowledge. Lesson study contributes to this kind of

professional development for teachers since learning occurs as teachers exchange ideas and co-plan activities for their students. Furthermore, the lesson study process focuses on student learning. Teachers, hence, are stimulated to think about improving their methods of instruction to improve student learning and, as Lenski and Caskey (2009) sustain, through lesson study teachers begin to assess learning from the students' point of view.

Following this first experience of leading lesson study, the advantages outlined above are realistic and one cannot deny that teacher learning takes place. Yet, many teachers are used to the more traditional transmission types of professional development which are often imposed by the Directorate, the College or the school. This approach to professional development, which leads teachers to experience it as top-down and in which they have no say, usually is perceived to be a waste of time. The key challenge of implementing lesson study is to convince teachers that professional development can take place in an informal and practical manner, and in which they can take responsibility and ownership for it.

Through the lesson study reported here, we have been exposed to some fundamental aspects of Japanese culture, one of which is *hansei* or the observation of one's reflection. Ermeling and Graff-Ermeling (2014) explain that self-critical reflection is viewed as an objective exercise which is carried out by teachers and school leaders to gather feedback and improve existing strategies. In fact, one must emphasise the importance of the post-lesson discussion where team members reflect on what was observed and address areas which need to be improved collectively. Adopting a reflective mindset in our daily professional practice is crucial to reach to "deep, substantive change and lasting results" (Ermeling & Graff-Ermeling, 2014, p. 189).

Acknowledgements

I would like to thank the following people without whom this lesson study journey would not have been possible. James Calleja and Laura Formosa, from the Faculty of Education within the University of Malta, for sharing their knowledge and experience on the lesson study process, for their guidance and constructive feedback throughout. Ainsley Cassar, Head of School at Birkirkara Primary School, for supporting this lesson study. Elaine Portelli and Rosanna Miceli Donnelly, my colleague and teacher and our Year 3 group assistant head respectively, as well as Jeanelle Attard, our mathematics support teacher for accepting to be part of the lesson study team and for their valuable

input throughout the entire process. Graziella Borg and Cynthia Galea, my class LSEs, for their participation in the lesson delivery and the post-lesson discussion. Finally, my thanks go to the students in my class for their active participation and cooperation.

Appendices

Lesson Plan

Date:	9th January 2024	**Grade:**	Year 3
Subject:	Mathematics	**Topic:**	Direction – clockwise and anticlockwise
Duration:	45 minutes	**Number of students:**	14 students

Remote Preparation:

- Students shall be asked to bring a ribbon approximately 1m long.
- Children are used to working in groups. Usually, 3 children are randomly selected and asked to choose their team and find a suitable space in the classroom within a set time frame e.g. 30 seconds. Although in most lessons children are free to choose with whom they prefer to work, they will be told that for this lesson, the groups have been previously set.
- The success criteria will be stuck to the children's desks, and they will be used as needed throughout the lesson.

Pre-requisites:

- Students would be familiar with the terms related to position and direction, such as 'left' and 'right' from previous lessons.
- Students will know the properties of a square, from previous lessons on 2d shapes.
- Students should be familiar with the following codes from "The Big Dance Party" coding lesson: star = arms and one leg up, triangle = dab, hexagon = high clap, circle = body roll, rectangle = this or that.

Learning Outcomes:

- 5.6.2: I can read and write the vocabulary related to position, direction (clockwise and anticlockwise) and movement.
- 5.6.7: I can use assistive technology and other resources appropriate to this level to learn about transformation geometry.

Lesson Objectives:

By the end of the lesson, the children will be able to:

- State whether a rotation is a clockwise turn or an anticlockwise turn, in a concrete, pictorial or abstract representation.
- Turn a length of ribbon in a clockwise or anticlockwise motion, as instructed.

Resources:

- Sarah's story
- 1m ribbon (per student)
- Whiteboards and markers (per group)
- PowerPoint (refer to image 1)
- Success criteria for clockwise and anticlockwise (refer to image 2)
- Random wheel spinner (refer to image 3)
- Concept cartoon on IWB (refer to image 4)
- Shapes for the coding sequence (refer to image 5)
- Self-assessment cards (refer to image 6)
- Worksheets (refer to image 7)

Introduction:

Presenting the problem through a story

Bella is a ballerina (*show image on PowerPoint slide 2*). Today she is at her dance class. Her teacher told her to stand on her tiptoes and hold a ribbon. Bella is very excited. She starts turning her ribbon in one direction and then in the other direction. Her teacher tells her that she needs to do 1 anticlockwise turn, 2 clockwise turns and 3 anticlockwise turns. Bella needs to practice until she gets the sequence right. Do you think you can help her?

Question prompts

- *What does the word clockwise remind you of?* (It is expected that most children would answer 'clock')
- *How do the hands of the clock turn? Show me using your pointer.*
- *How can Bella remember which way to turn the ribbon when she is doing anticlockwise turns?*
- *How do you think she needs to turn the ribbon?*
- *Does a turn always have to be vertical?* (It is expected that most children would not know what a vertical means, hence a demonstration of a vertical turn would be needed)

The activity will start off with the children seated on the carpet at the front of the classroom. Halfway through the story, children will be expected to stand up and follow the instructions using their ribbons. During the activity, the teacher assesses prior learning and whether the students are already familiar with the terms.
(5 minutes)

Development:

Explanation of the concept

The teacher states the learning intention of the lesson. She explains the terms 'clockwise' and 'anticlockwise' using slides 3 – 6 on the PowerPoint presentation.

The children stand up behind their chairs and practice turning the ribbon in a clockwise and anticlockwise direction, depending on the direction that shows up when spinning the spinner: Clockwise or Anti-clockwise - Random wheel (wordwall.net) (slide 7)
(10 minutes)

Group work

A concept cartoon will be displayed on the IWB (slide 8). The teacher will read the phrases and ask the students to think about them. The children form three groups as follows:

Group 1: Student 1, Student 2, Student 3, Student 13, Student 14

- Student 13 will be the team leader, and they are to work at his desk. The group will be observed by Ms. Jeanelle and Ms. Cynthia.

Group 2: Student 5, Student 6, Student 7, Student 8

- Student 7 will be the team leader, and they are to work at his desk. The group will be observed by Ms. Graziella and Ms. Elaine.

Group 3: Student 9, Student 10, Student 11, Student 12

- Student 11 will be the team leader, and they are to work at her desk. The group will be observed by Ms. Miceli and Dr Calleja.

Each group is handed out a copy of the concept cartoon. In their groups children are to discuss the statements while the timer goes on slide 9 of the presentation.

Question Prompts

- *Do you agree with any of the statements?*
- *Which one do you agree with?*
- *Do you think Ben's idea will work?*
- *Why do you think he is right/wrong?*
- *Did you try it out?*
- *Will Ben's idea work if he turns clockwise instead of anticlockwise?*
- *Can you find another way of walking in a square?*

The children may write/draw the solution to the final question on their whiteboard (one per group), hence using a pictorial representation of the concept.
(15 minutes)

Whole class discussion (The Neriage Phase)
The teacher prompts a whole class discussion using the following question prompts:

- *Can you give me directions for walking in a square?*
- *What is the difference between the squares that I am making?*
- *Is there a difference in shape? Size?*
- *Does turning clockwise or anticlockwise make a difference in the shape? When does it make a difference?*
- *What happens if I change the number of steps that I take, halfway through the shape? Will I still be making a square?*

(10 minutes)

Conclusion:

Summing up with a coding activity
The students would have previously participated in a coding lesson (Dance party unplugged: Dance Party: Unplugged - Lesson 1 - Code.org). The children revise the shape codes and movements assigned to each code (star = arms and one leg up, triangle = dab, hexagon = high clap, circle = body roll, rectangle = this or that). The codes for the circle and the rectangle are changed to a clockwise and an anticlockwise movement using ribbons, respectively (refer to slide 10 on the PowerPoint Presentation). In their groups, children create a code by selecting 6 shapes and putting them in order. They will then perform a dance sequence by following the code and making the corresponding movements for each shape.

At the end of the lesson, the teacher gives out the self-assessment cards and asks the students to evaluate their learning by marking the correct picture on their cards.
(10 minutes)

Differentiation:

- Children who struggle to understand the mathematical concept will be encouraged to look at the clock before deciding whether a turn is in a clockwise or anticlockwise direction.
- Children who grasp the concept quicker will be encouraged to think of how they use clockwise and anticlockwise turns to go to different areas within the school (e.g. To refill their water bottle, to go to the dismissal area, to go to the playground, to go to the headmaster's office, to go to the class in which they were last year).
- John (a child with autism) will be given a ribbon, and he will practice turning the ribbon in either direction. A separate activity will be prepared for James, whereby he will work on his fine motor skills by making clockwise and anticlockwise turns using a paintbrush.
- Leon (a child who also has autism) should be able to follow the lesson and participate in the activities with minimal prompting by his LSE.

**Student names have been changed.*

Assessment:

- The success criteria will be handed out to the students and kept on their desks throughout the lesson.
- The teacher is to assess student learning through observations and student participation.
- By the end of the lesson, the teacher should have a clear idea of where the students stand in their learning by noting whether their representations are at a concrete, pictorial or abstract level.
- A self-assessment card will be handed out to the students at the end of the lesson to check whether they are confident that they have learnt the directions of the turns.

Anticipated issues and misconceptions:

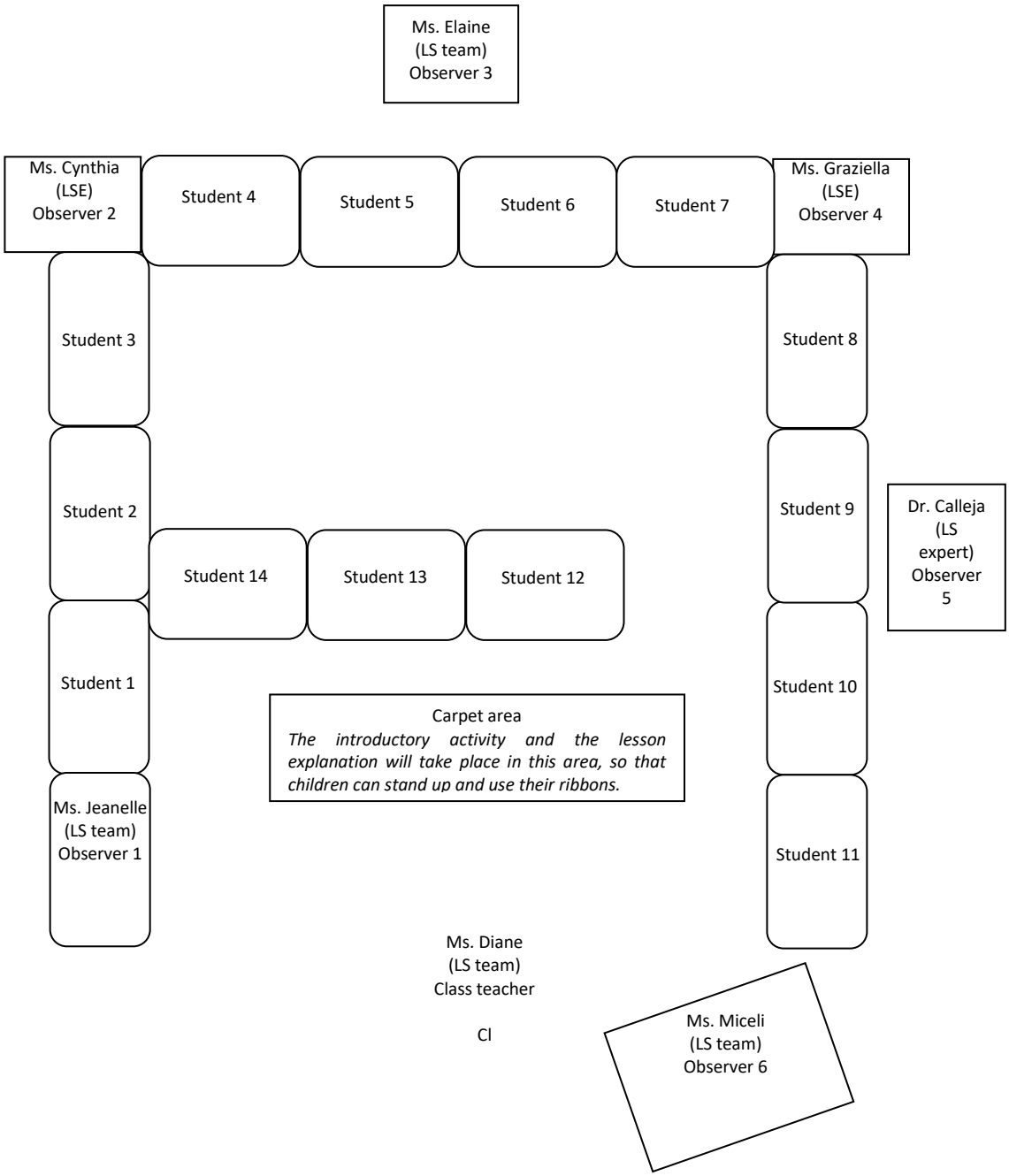
Students will probably struggle with the concept cartoon activity. The teacher will read the statements in order so that children with literacy difficulties will not hinder the mathematical concepts being assessed. While

the teacher is going around the groups, she will re-read the phrases to children who require further assistance. Question prompts and encouraging children to walk in a square and think about the direction in which they are moving should enable most groups to carry out the task.

Homework:

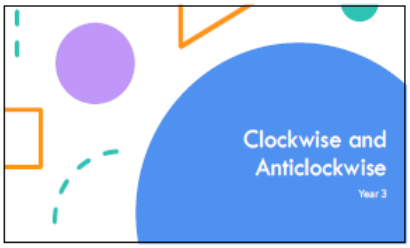
A worksheet will be assigned as a homework task, provided that the objectives are reached. If not, a reinforcement lesson will take place in the next Maths lesson, and the worksheet will be handed out the next day.

Seating Plan



Resources:

PowerPoint presentation slides



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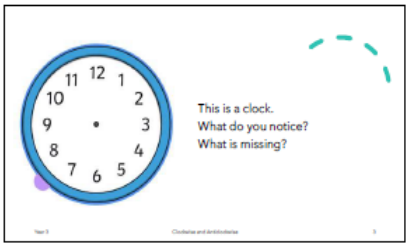

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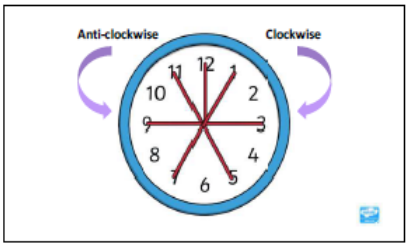

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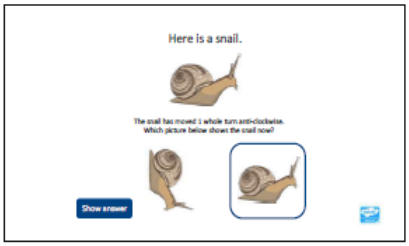

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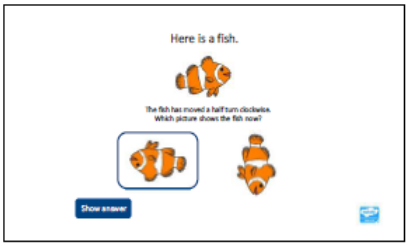

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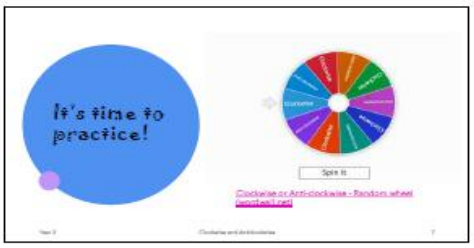

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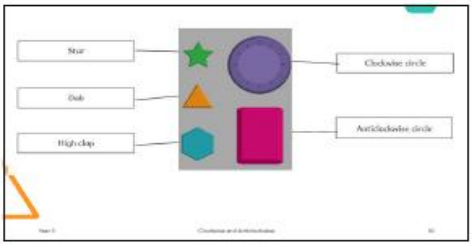
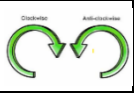


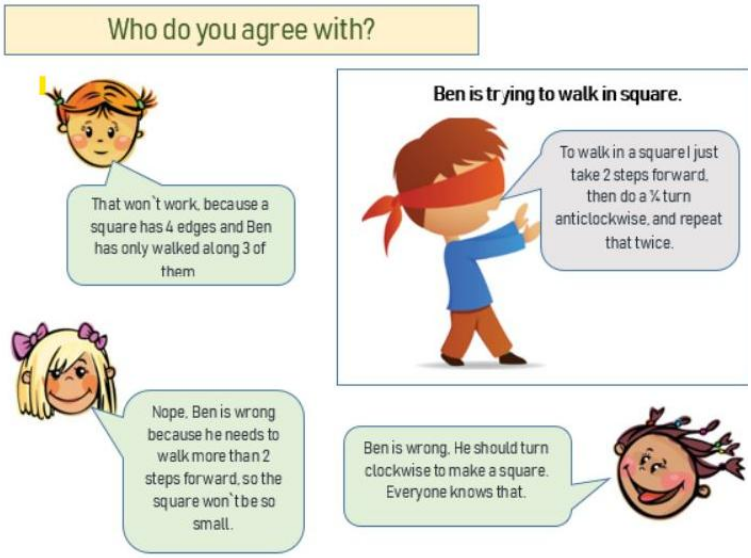
10

Success criteria

I am learning to recognise a clockwise or anticlockwise turn.	**Teacher Hint**
I know that 'clockwise' means the object turned to the right.	
I know that 'anticlockwise' means the object turned to the left.	
I can identify whether an object has turned clockwise or anticlockwise.	

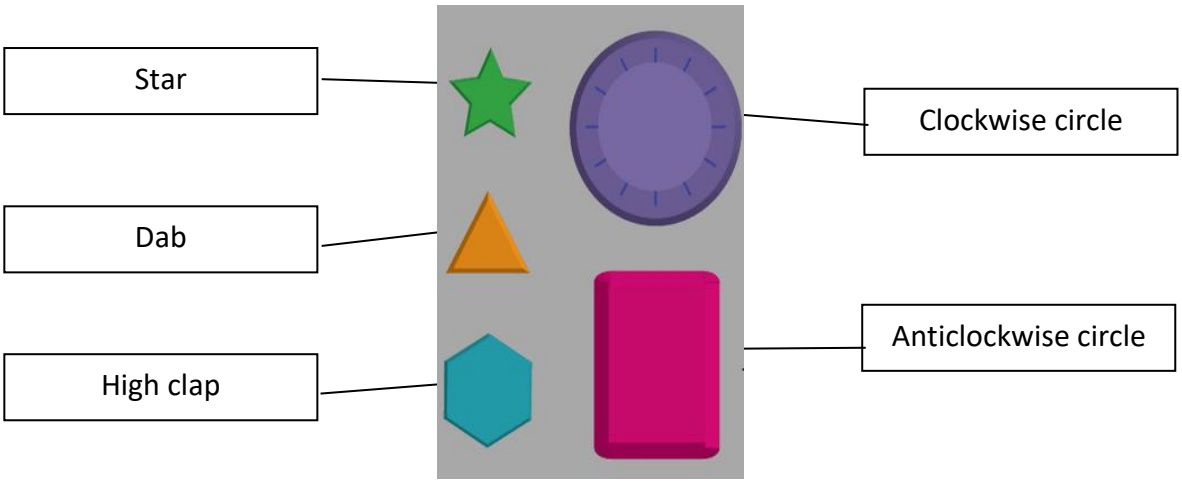
Random Wheel Spinner

Concept Cartoon



Shapes for Coding

Self-assessment Card



Name: _____

I know that clockwise means that the object turned to the right.

I know that anticlockwise means that the object turned to the left.

I can tell whether an object has turned clockwise or anticlockwise.

Worksheet

Success Criteria

I am learning to recognise a clockwise or anticlockwise turn.	Teacher Hint	Self-assessment
I know that 'clockwise' means the object turned to the right.		
I know that 'anticlockwise' means the object turned to the left.		
I can identify whether an object has turned clockwise or anticlockwise.		

How have these animals turned? Clockwise or anticlockwise?

	
1. _____	2. _____
	
3. _____	4. _____
	
5. _____ _____	6. _____
	
7. _____	8. _____

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