

What GCSE Maths resit learners say about Word Problems: Collecting data through a revision workshop

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Solving word problems (WP) is often challenging for less highly-attaining GCSE mathematics students. In a previous study I conducted, 16-18 years old GCSE Mathematics resit learners in an English Further Education college typically reported that they had not been taught strategies for approaching such problems. Consequently, they faced difficulty in applying their classroom knowledge to examinations. The current study aimed to explore the methods such learners employed when tackling WP, both in the classroom and during formal examinations. Initially, I planned a narrative approach. However, during the pilot phase, I observed that many learners hesitated to participate fully in focus groups, due to their reluctance to share their stories with peers. Although there is evidence that learners can greatly benefit from such exchanges, I respected their preferences and adjusted the study design accordingly. I instead gathered data via a carefully planned mathematics word problems workshop. In this reflective essay, I discuss the workshop design process and the related ethical issues.

Keywords: GCSE Maths; resit; further education; word problems; data collection; workshop

Introduction and Rationale

In March 2020, I conducted a small research study in a central London further education (FE) college with the intention to explore the previous and current experiences of my GCSE (General Certificate of Secondary Education) mathematics resit learners. GCSE is an important examination that learners in the UK sit at the age of 16. A learner who has not achieved a grade 4 or above in maths and/or English is required by condition of funding to resit the examination when enrolled into a post-16 education course. My aim therefore was to understand better the factors that shaped their attitudes towards mathematics and how experiences affected their achievement and engagement. For that study, I followed a narrative approach and although the number of participants was small (7 learners), several common themes emerged from their narratives.

One key theme was related to the nature of the questions in formal examinations, the 'wordy ones' as they called them. Very often they would feel unable to demonstrate their knowledge in exams as well as they could in the classroom. They also expressed dissatisfaction with the lack of guidance they felt they had in lessons around solving more complex word problems such as the ones appearing towards the end of a GCSE Mathematics examination paper. They said that the focus was mainly on training them to answer the one/two-steps procedural questions or spot key words that would help them collect the marks needed to achieve a standard pass (grade 4).

As a maths teacher and curriculum manager in a FE college, I have experienced first-hand the struggle that many resit learners face when solving mathematical word problems (WP). Understanding the mathematical concepts within a context is essential for examination success and real-life applications. However, both the literature below and my own research indicate that WPs pose particular challenges for resit learners. This has motivated me to further explore the concerns my learners expressed around WPs, show them that their voices are heard and eventually develop strategies to help them comprehend and solve WPs with confidence. To achieve the latter, I needed first to understand how their existing knowledge and approaches to WPs had been developed over the years and what kind of attitude they bring in a resit classroom.

Research over the past 50 years has highlighted various difficulties learners encounter when solving WPs, including comprehension issues, linguistic complexity, challenges in transitioning from informal to formal mathematics, vocabulary deficiencies, and learners' beliefs and motivational levels (Verschaffel et al., 2020; Ramirez et al., 2019; Shoenfeld, 2016; Fischer & Shaki, 2014; McLeod & Adams, 2012). However, the group of learners I am working with, the GCSE mathematics resit learners, have not received much attention in research although FE is a key sector of mathematical underperformance that is costly to individuals and society (Smith, 2017). There is currently no research around these students' perspectives on the issues surrounding their engagement with WPs. They are likely to have repeated experiences of failure and consequent impact on self-efficacy (Smith, 2017), which have created a cycle of disengagement and low attainment.

Student voice plays a vital role in educational research and reform for improving our theoretical and professional understanding (Robinson & Taylor, 2007; Harfitt, 2014). In my previous study, learners provided valuable insights into the influences on their mathematical trajectories, and they felt affirmed by their perspectives being valued. Giving voice to learners who have not yet achieved a standard pass is critical, as they are often overlooked and face limited opportunities in further study and future career.

The purpose of my current study, therefore, is to explore further the experiences and approaches that the resit learners within my FE college have previously developed and currently follow regarding WPs. The two research questions I will try to answer are:

1. What has been GCSE mathematics resit students' experiences of WPs in previous schooling years?
2. What are their perceptions of, and approaches to, exam/assessment WP questions?

In the following sections I discuss the methods I used to conduct my research. In particular, I discuss the use of a revision workshop to gather qualitative data in contrast to the use of focus groups that I had originally planned and its ethical considerations.

Methodology

In the current study, I adopted a historical narrative approach, situated within the qualitative or interpretive tradition (Moen, 2006) and which uses participants' own stories as a foundation for interpreting the phenomenon under examination. Moen (2006) emphasises the importance of understanding human behaviour in relation to the circumstances in which they occur and how those have evolved over time. While

designing and later conducting the study, I was aware that that a narrative approach has a particularly subjective nature, shaped collaboratively by myself and the participants. To enhance its trustworthiness, I refrained from using leading questions and provided ample space and time for each participant to feel at ease while engaging with the process and narrating their experiences in their own way. Furthermore, I offered them the opportunity to validate or edit the subsequent written interpretations, ensuring their voices are well represented in my thesis and other written accounts of the study.

My primary interest was to understand how individuals assign meaning to their experiences with WPs, both generally and in preparation for high-stakes examinations. Through this approach, I aimed to identify the aspects of these experiences that are emphasised in the narrations they share. I chose this approach because it gives voice and power to the individual learners (Cook-Sather, 2006; Robinson & Taylor, 2007). The focus events suggested ways in which learning attitudes and behaviors had been shaped.

Below, I explain in more detail how I obtained the data to answer my research questions following an exploratory mixed methods approach where the data collected from a qualitative method (workshop) informed the development and implementation of a quantitative method (online survey) (Creswell & Clark, 2017).

Data collection

The gathering of the data occurred in three stages: a) teacher survey, b) revision workshop with learners and c) online learner survey. The purpose of the teacher survey was to capture teachers' perspectives regarding WPs, the approaches they teach learners to follow, the level of WP exploration and their emphasis within their lessons and their awareness of the challenges their resit learners face when working on WPs. The revision workshop was held to give participants the opportunity to share experiences and benefit from possible commonalities. The main aim was for the participants to interact with each other, listen to each other's experiences and contribute to discussion and explore strategies that they could use when working with WPs. Their contributions fed into the design of the online survey which was distributed to all GCSE Mathematics resit learners in my FE college. Finally, the aim of the online survey was to give the opportunity to all learners to write about their experiences with mathematics and present their approaches to GCSE WPs.

The novelty here is the use of a revision workshop to collect data. Below, I explain in detail the reason I chose this method and present the design process.

A revision workshop to collect data

My original intention was to conduct semi-structured interviews with focus groups (FG) for the qualitative part of my study. To make sure that the trigger questions and WP tasks I had developed would generate the data needed to answer my research questions I planned to run a pilot FG asking my learners to participate. I explained to them what a FG is, i.e. a small group of learners meeting in college at a convenient time to discuss WPs, and of course I clearly explained their purpose. Unfortunately, only four learners volunteered and from those only one attended.

Curious about why my learners were reluctant to participate in the FG I asked for feedback to help me find an alternative way of collecting my data. Out of the fifteen learners, ten claimed that they felt shy or even anxious discussing their previous experiences in front of others, though also volunteered that they would be

content to discuss it in a one-to-one setting. This occurred in mid-October, a time when learners were still getting to know each other as they came from different vocational areas within the college. I respected their decision. Although individual interviews were an option (my 'plan B'), I still believed that an element of sharing experiences with their peers would benefit them, perhaps helping them realise that they were not alone and that many others had similar experiences, feelings and attitudes towards mathematics and WPs.

The revision workshop occurred to me because it was something learners were used to as it was part of their college life, attending revision workshops for maths or other subjects. The idea was to plan it with dual benefit to learners, sharing experiences with each other and improving their knowledge on how they might approach and solve WPs. However, this is not a common in research method and I found only one nursing paper with a similar approach by Treloar et al. (2017) which I used to inform my design.

Workshop design and implementation

Key purposes were:

1. To provide an opportunity for GCSE maths resit learners to share and reflect on their experiences with mathematics and the approaches they have developed towards solving WPs over the years, so benefiting learners in two ways as mentioned above.
2. To analyse their narratives to inform the development of an online survey which would be distributed to all GCSE Mathematics resit earners in the college.
3. To discuss and develop potential strategies towards WPs and practise with past examination questions while working collaboratively.

The workshop run in early February, when learners had just started preparing for their 'mock' examinations. It was advertised to every resit learner in the college (412 in total) by text message and the teachers also helped to convey its purpose. 12 learners attended which was a productive number in terms of variety of student and attention available. The workshop consisted of three parts: *a) learners' reflection on their experiences with WPs, b) strategies for approaching and solving WPs with examples and c) practice on past examination questions.*

In the first part of the workshop learners were prompted to answer 5 questions related to general experiences with mathematics, 3 questions regarding WPs and worked on a small task. The purpose of the first 5 questions was to stimulate memories about their relationship with mathematics and the next 3 to start a conversation about WPs. Before becoming involved into a conversation, participants were given time to think and write down their thoughts. Then they were asked to share their thoughts if they wished to. The task consisted of 4 carefully selected WPs covering different mathematical areas that learners find challenging, split in two sections. Firstly, the participants were shown the WP situation without any question and were asked, for example, *do you understand the context of this problem? what kind of feelings arose when you saw this problem? is there anything missing? etc.* Then they were shown the same problem including the question and reported any different feelings or thoughts that were developed. The aim of the task was to maximise opportunities for individual contribution and elicit their thinking processes when face a WP. In this first part, I wanted to engage the participants in thinking, doing and communicating as well as listening to each other's narratives.

The second and third part were designed as a ‘more usual’ revision workshop where learners had the opportunity to discuss the approaches they had already developed towards solving WPs, were introduced to different strategies through specific examples and spent time implementing some of those, or other, approaches to past examination problems, working in groups of 3 or 4. The workshop lasted for 3 hours but some learners stayed a bit longer to follow up some of their work with me.

Ethical considerations

Initial ethical considerations included issues around the use of a workshop as a means of collecting data. Firstly, the workshop aimed to benefit participants’ learning and improve their approaches to solving WPs. It was advertised to every GCSE Mathematics resit learner in the college, so it was inclusive, offering them a chance to understand their current state with WPs, discuss the challenges they face, receive strategies to overcome those challenges and practise those strategies to see which one works for them. To ensure voluntary participation, every resit learner received a text message informing them of the workshop and its purpose, and attendance was entirely optional.

Prior to the start of the workshop, I provided participants with a detailed explanation of both learning and research purpose and structure, both verbally and in written form. Consent forms for use of their data for research purposes were completed at the outset and I made it clear that if any participant did not wish for their narratives to be used for my research, they could still attend the workshop without any obligation. All participants were comfortable with this arrangement. Additionally, I informed them that no real names would be used and that they could withdraw their data at a later stage if they changed their mind.

I understand that it is not always easy to express and share one’s thoughts in front of others and that sometimes this can cause feelings of pressure and anxiety. To address this, in the first part of the workshop where the questions were more personal, I asked participants to write down their responses and only share with the rest of the group if they felt comfortable to do so. I told them that I would collect their written responses at the end of the workshop. I made a conscious decision not to audio record their responses, as my main intention was to provide learners with a secure space to their experiences, and only then use those to support the design of the online survey.

In comparison to the initial design of focus groups, the workshop offered a more familiar and less formal setting for the learners. It gave learners the opportunity not only to share and listen to each other’s’ experiences but also to enhance their learning and actively engage with WPs.

Lastly, the workshop was led by me. In the eyes of the participants, my role was threefold: researcher, maths teacher, and curriculum manager. I was aware that this arrangement could potentially lead to power conflicts and create confusion. However, the participants were well aware of my identity as they had seen me before in their classrooms, in my office and around college. From the beginning, it was made clear that I would be conducting the workshop and that attendance was optional and open to every GCSE resit learner. Participants were assured that their responses would have no negative impact on any college records or grades. They understood that my role was to listen to their stories, facilitate the conversations and provide strategies that could help them improve their understanding and approach to word problems. Their narratives were treated with respect and confidentiality. Participants were made aware that pseudonyms would be used if needed to refer to their narratives

and that they were able to review my interpretation of their stories before submission of my thesis.

Conclusion

While the initial plan was to conduct semi-structured interviews with focus groups, the workshop emerged as a more suitable and familiar setting for the learners. I carefully designed the workshop to encourage interaction, reflection, and learning from each other's experiences. The aim was to create a safe space for participants to share their thoughts and enhance their understanding and approaches to WPs. Ultimately, their responses helped me design a robust online survey which was distributed to all resit learners in the college and received 112 responses. I am now in the process of analysing the data and writing my final thesis.

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