

Study N° 30002203

Version 5

2025/01/23

Consent Form for Parent's Participants

Is there a link between some components of visuo-spatial processes and mathematical competencies?
A focus on neurotypical and autistic students. Work
Plan 1

1. Study Personnel

This study is a collaborative effort between researchers in Canada and Belgium. In Canada, the Principal Investigator is Prof. Grace Iarocci, Professor at Simon Fraser University (SFU), and Director of the Autism and Developmental Disabilities Lab. In Belgium, the co-investigator is Prof. Virginie Crollen, Professor at Université Catholique de Louvain, and Director of a neuroscience lab. The Lead Student is Elise Rombaux, conducting the study as part of her PhD Thesis.

Contact information

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Co-investigator and UCL faculty supervisor: Virginie Crollen, Faculty of Psychology and Educational Sciences, Institute of Psychology. e-mail: Virginie.crollen@uclouvain.be

Lead Student: Elise Rombaux, PhD student. E-mail : elise_rombaux@sfu.ca

2. Invitation

You are invited to participate in this study because you are a parent of a child currently developing visuo-spatial and mathematical competencies at school.

3. Voluntary Participation

Your decision to participate in this study is entirely voluntary. You may choose not to participate without providing justification, and your decision will not result in any

Study N° 30002203

Version 5

2025/01/23

prejudice. If you decide to participate, you may still choose to withdraw from the study at any time without any negative consequences to the education, employment, or other services to which you are entitled or are presently receiving.

4. Who is Conducting this Study?

The present study is funded by the Wallonie-Bruxelles International Grant and conducted by a Lead PhD student and two co-investigators.

5. Background

The existing body of research on numerical cognition consistently highlights that visuo-perceptual (VP) abilities form a crucial foundation for numerical and mathematical learning. Children with VP disabilities, in particular, have been observed to encounter challenges in basic numerical tasks. Additionally, deficits in number-to-space mapping have been linked to dyscalculia. Upon closer examination of these studies, a significant issue emerges there is substantial variation in the spatial skills measures employed, and a consensus is lacking regarding which visuo-spatial skills impact specific aspects of mathematical learning.

Beyond neurotypical children, individuals with autism spectrum disorder (ASD) have been noted to exhibit both weaknesses and strengths in mathematical abilities. Notably, some ASD individuals demonstrate exceptionally high scores in visual reasoning. However, up to this point, there has been a lack of analysis concerning a potential connection between elevated visuo-spatial skills and heightened mathematical abilities in this population. Furthermore, studies conducted in natural settings, involving cohorts of students in classrooms, remain limited. This gap is noteworthy, given the significance of such research in informing the development of effective visuo-spatial and mathematical teaching programs for our students.

6. Purpose of the Study:

In response to the limited practical applicability of recent studies in shaping mathematical and visuo-spatial teaching approaches, our primary objective is to address this challenge. The study has three main goals:

1. Systematic assessment of different visuo-spatial components (i.e., visuo-perceptive, visuo-spatial, and visuo-constructive abilities) in students facing difficulties and following typical development in mathematical learning.
2. Examination of the Visuo-spatial-numerical link in ASD children. In a secondary approach, we plan to explore a population exhibiting either weaknesses or strengths in mathematics, which is also present in our

Study N° 30002203

Version 5

2025/01/23

classrooms. Given the variability in mathematical competencies within the autism spectrum disorder (ASD) population, adapting mathematical interventions for neurodivergent children is crucial.

3. Development and testing of a visuo-spatial classroom-training program. Our third approach involves considering these dissociations to develop a visuo-spatial classroom training program, which will undergo further testing.

7. Who can participate in this study?

Any student aged between 7 to 11 years old can participate.

8. Who should not participate in this study?

Students not aged between 7 and 11 years old should not participate. If your child presents severe and uncorrected vision impairment, please inform us if you want them to participate and how we can accommodate them.

9. What does the study involve?

The study involves your child undergoing screening and experimental tasks. Screening tasks include assessments of oral language (in their dominant language), reasoning and executive functions. Experimental tasks include visuo-spatial and mathematical tasks. The procedure will be divided into 4 sessions to accommodate school schedules, with a total experiment time of approximately 3 hours. Your child will participate in ten activities that are aligned with the mathematical curriculum and will take place in the classroom with the teacher and the researcher. Although, if you have not consented to your child participating in the research, your child's results will not be recorded in the study. Students whose parents have given their consent will individually participate in three additional activities in a quiet room near the classroom: a task involving repeating sentences, a task involving moving cubes to replicate a shape, and a task involving pointing to a sequence of cubes in the same order as presented by the adult. During the latter two tasks, the research student will record your child's hands (and only the hands) as they move or point to the cubes, in order to analyze potential types of errors, which will greatly aid in the analysis of the results.

10. Overall Design of the Study:

120 students representing inclusive classrooms will be tested on both mathematical and visuo-spatial tasks. The study will utilize a task inspired by the cube subtest of the WISC-V and various tasks on mental rotation, pattern recognition, and drawing to assess visuo-spatial abilities. Mathematical abilities will be assessed through tasks

Study N° 30002203

Version 5

2025/01/23

inspired by the EXAMATH 8-15. Participants will perform tasks that take 3 hours in total. These tasks will be divided in 3 sessions of 50 minutes in classroom altogether and one session of 30 minutes in a quiet room outside the classroom where students are performing one by one on tasks. Results will be correlated to identify links between visuo-spatial abilities and mathematical learning, contributing to the development of a visuo-spatial training program. At the beginning of the study, you will complete a questionnaire regarding your child's development.

Study Visits and Follow-up:

Once you sign the Consent Form, the Lead Student will visit the classroom to explain the project and conduct a discovery activity with the participating students. The Lead Student will then visit the classroom 3 to 4 times during the year to conduct testing sessions. Parents will be given feedback by e-mail and through our website at the end of the study.

11. Possible Harms and Discomforts

Possible risks perceived by the participant include fear of unknown activity, fear of being with a stranger, fear of being judged and/or penalized by the teacher if not participating, withdrawing, or missing learnings. The research team will take steps to maintain those risks minimal by introducing the Lead Student, temporary helping students and the project to the classroom through a presentation in classroom. Students will not be told their performance on the tasks and will in anyway receive the motivation tools for participating to the visuo-spatial journey. Lead student will team up with teacher to ensure minimal impact on teaching time. It will be explained to students (through this presentation and through an assent form) that over 13 activities, 10 are considered as part of the curriculum by their teacher but that we will not record their result if they do not wish to (even if their parents gave their consent). They will also be explained that they are not obligated to perform on the 3 tasks that are conducted outside the classroom if they don't want to, without any prejudice or justification.

12. Potential Benefits of Participating:

Your participation will contribute to creating an evidence-based and inclusive classroom program for visuo-spatial and mathematical learning. It also raises awareness of the importance of visuo-spatial learning for various skills. If you wish to, you are allowed to ask the researcher to receive your child's results. In that case, you will receive the total of correct responses for each task. When receiving these results, you should be aware that:

- This does not represent a diagnosis in any way;

Study N° 30002203

Version 5

2025/01/23

- There are currently no norms to which these results can be compared to;
- We will not share these results with your child's teacher without obtaining your prior consent. At the end of this form, you will have the option to: agree to have us automatically share the results with the teacher; refuse to have the results shared automatically with the teacher; or request that we ask you again later (in case you would like to review your child's results yourself before deciding whether to share them with the teacher).

13. After the Study is Finished

Data will be analyzed, and feedback will be provided on the website. You can ask questions through the website's contact form. The results of this study will be reported in a graduate thesis and may also be published in journal articles and books.

14. Withdrawal of Consent:

You have the right to withdraw your consent at any time without justification, and it will not prejudice you. Verbal or written withdrawal will be accepted. De-identified data cannot be withdrawn once the study is published.

15. End of Participation

Participation may end if the project is stopped by the sponsor or if a regulatory agency or Research Ethics Board ends it due to unexpected serious adverse events affecting participant safety. Notice will be provided via email and the website.

16. Confidentiality

All documents will be identified only by a unique code number and kept in a locked filing cabinet. Participants will not be identified by name in any reports of the completed study.

Once your identifiable data is collected, it will be encoded and securely stored on an USB in the ADDL lab at Simon Fraser University. Access to this data will be limited to the Principal Investigator and the Lead Student for the duration of the project. Coded or de-identified data, essential for research team manipulations during the study (e.g., understanding the number of participants with Developmental Language Disorder (DLD) to control this variable while analyzing the link between visuo-spatial abilities and mathematical abilities), will be separated from identifying data.

Study N° 30002203

Version 5

2025/01/23

The coded data, including spoken languages, relevant diagnoses, grade, age, and hands video records will be shared among the research team members through a secure RedCap File during the study. This file will be shared permanently with our Belgian co-investigator and temporarily with a few research students in Belgium. No directly identifying (names, contact information, date of birth) data will be disclosed. Only the Principal Investigator and the Lead Student will have the ability to re-identify your data during the study, if necessary, as they are the sole individuals with access to the code.

The option to re-identify someone will only be exercised in the event of a significant problem with our data. For instance, if a participant performs notably worse than others and the researcher observes severe vision problems, they may need to determine if the student wore glasses during the test day to correct the data.

After publication of the study, your identifying data will be permanently deleted from our database. De-identified data will remain stored on an institutional repository in order to respect the Open Sciences principles.

Any study-related data sent outside of Canadian borders may increase the risk of disclosure of information because the laws in those countries dealing with protection of information may not be as strict as in Canada. However, all study-related data that might be transferred outside of Canada will be coded (this means it will not contain your name or personal identifying information) before leaving the study site. By signing this consent form, you are consenting to the transfer of your de-identified information, to our co-investigator organization located outside of Canada: Université Catholique de Louvain, Belgium.

17. Contact for questions

Our team will answer any inquiries concerning your study to ensure they are fully understood by the participant. You can contact us through our Website contact form or by e-mail: elise_rombaux@sfu.ca

18. Contact for complaints

If you have any concerns about your rights as a research participant and/or your experiences while participating in this study, please contact the Director, SFU Office of Research Ethics, at dore@sfu.ca or 778-782-6593.

Study N° 30002203

Version 5

2025/01/23

19. Consent Acknowledgement

At the end of this study, your child's results could potentially help their teacher better understand each student's strengths and challenges, allowing them to adapt their teaching practices accordingly. If you authorize the teacher to see your child's results, please note that they are not allowed to share these results with anyone else, as stated in their consent form. However, you are entirely free to choose not to share any results, without providing any justification and without any consequences.

Please **check the option that best suits you:**

- ☐ I would like my child's results to be shared directly with their teacher at the end of the study.
- ☐ I would like to be asked again at the end of the study.
- ☐ I do not want my child's results to be shared with their teacher.

Taking part in this study is entirely up to you. You have the right to refuse to participate in this study. If you decide to take part, you may choose to pull out of the study at any time without giving a reason and without any negative impact on you or your child's life at school.

- Your signature below indicates that you have received a copy of this consent form for your own records.
- Your signature indicates that you consent to participate in this study.
- You do not waive any of your legal rights by participating in this study.

I have read, comprehended, and acknowledge the information regarding the study. I willingly give consent for my child to participate in this study.

Please

Parent/Guardian's Full Name: _____

Child Full Name: _____

Signature: _____

Date: _____