

# Bogumila Gierus

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## Employment

### Graduate Assistant Researcher – Math Minds Project (August 2022– Present)

*Werklund School of Education, University of Calgary*

**Weekly meetings:** Discussion of various math related topics. Preparing for these meetings by doing research in the field of math education and other.

**Evaluation and improvements of Math Minds resources:** The Math Minds resources is an online interactive course. One of my major contributions is the continuous editing of these resources to check for consistencies in the math and the language used in this resource.

**Preparing and contributing to Professional Learning Days for teachers:** The Math Minds Project also involves professional learning experiences during the year for teachers to engage with the Math Minds approach to teaching. I help in the preparation for these workshops and sometimes present content.

**Analyzing feedback from Professional Learning Days:** After each professional learning day, the teachers engage in feedback surveys. I analyze these surveys and report back to the Math Minds team with the results and possible ways to improve the next Professional Learning workshop.

**On-site visits with teachers:** I traveled to Northern Alberta (Northland School Division) and developed relationships with math teachers in the Anzac schools to implement the Math Minds teaching approach.

**Project Supervisor:** Dr. Armando Preciado Babb and Dr. Brent Davis

### Instructor – ENG 100 Bioengineering Summer Institute (July 2023 – August 2023)

*Schulich School of Engineering, University of Calgary*

**Teaching:** Taught the basic principles of physics to students entering bioengineering with no background in physics. Taught lectures, led labs, and provided one-on-one instruction. Met with students daily to assist their learning and advised them on ways to improve their understanding.

**Project-based approach:** Developed labs and projects used in the class to promote learning and engaging with the material in a hands-on approach.

**Guest Speakers:** Secured weekly guest speakers to present students with a variety of different options/careers of engineering.

**Marking:** Marked student ongoing daily quizzes and weekly assignments and major term projects. Met tight timeline for marking. Gave individual feedback to all students.

**Team-Teaching:** Worked closely with co-instructor to provide a cohesive program.

### Graduate Assistant Researcher – Robots and Mathematical Reasoning (October 2022 – Dec 2022)

*Werklund School of Education, University of Calgary*

**On-site weekly visits to classroom:** Observations of the class activities with Robots. Video recordings of the student participation. Discussions with students about their learning. Discussions with teachers about the implementation of the program. Help with technical issues associated with Robots.

**Preparing and contributing to Professional Learning Workshops for teachers:** There were two workshops for teachers to understand how to build and program the robots. These workshops included a scholarly component, such as reading and discussing a scholarly article. I helped prepare some of the material for these workshops and assisted teachers during the workshops.

**Data implementation and analysis:** I oversaw the data collection, transcription of video recordings, data analysis, and other data related activities.

**Project Supervisor:** Dr. Brent Davis and Dr. Krista Francis

## Graduate Assistant Researcher – Board Games and Spatial Reasoning (September 2022 – March, 2023)

Werklund School of Education, University of Calgary

**On-site weekly visits to classroom:** Observations of the class activities with Board Games and Spatial Reasoning. Video recordings of the student participation. Discussions with students and teachers.

**Preparing and contributing to Professional Learning Workshops for teachers:** Throughout the year, there were eight workshops for teachers to learn how play the board games and what kind of spatial reasoning is involved in each. These workshops also involved a reading and discussing component of a scholarly article, which I was instrumental in selecting. I also helped prepare some of the other material for the workshops and assisted teachers.

**Data implementation and analysis:** I oversaw the data collection, transcription of video recordings, data analysis, and other data related activities.

**Project Supervisor:** Dr. Krista Francis

## Graduate Assitant Teacher – SCIE 331 Scientific Explorations (January 2023 – April 2023)

Natural Science Program, University of Calgary

**Weekly student meetings:** Met with students on a weekly basis to assist their learning and advised them on ways to improve their weekly assignments and their term projects.

**Marking:** Marked student ongoing weekly assignments and major term projects. Met tight timeline for marking weekly assignments. Gave individual feedback to all students.

**Course Instructor:** Dr. Laura Mazzino

## Employment History

### Physics, Science, and Math Teacher (February 2012– June, 2022)

Webber Academy, Calgary, AB

**Taught high school courses:** AP Physics 1, AP Physics 2, AP Physics, Physics 20 (grade 11 physics course), Physics 30 (grade 12 physics course), Science 10 (grade 10 general science course), Chemistry 20 (grade 11 chemistry course), Math 20-1 (grade 11 university prep math course), and Applied Science Project (independent research project course for grade 11 students).

**Developed the Applied Science Project credit course:** intended to create an enrichment opportunity for senior high students to design, develop, and carry out an independent research project of their own choosing under the mentorship of an expert from academia or the private sector. Up to now, 60 students participated in the course; many of these students participated in the Calgary Youth Science Fair and achieved top rankings at the regional fair.

**Initiated and organized Science Fair program at the high school:** started and grew the program for students from grade 7 -12; every year many students receive major awards at the regional fair and are chosen to participate in the Canada Wide Science Fair; Some of the students also participated in ISEF Regeneron International Science and Engineering Fair. Webber Academy received the top regional high school award in 2021. I received the **BP Outstanding Science Fair Coordinator Award**.

**Organized a trip to Saskatoon, to the Canadian Light Source (CLS):** arranged and supervised the trip for a team of 15 grade 10-12 students to the only synchrotron in Canada (CLS) to perform an experiment on one of the beamlines.

**Organized and prepared students for Physics Contests** such as Sir Isaac Newton Contest, the Canadian Association of Physicists Prize Exam, the Physics at Mac contest, the F=ma contest, the Physics Bowl contest, the APEGA Science Olympics, Science Engineering and Technology Challenge

### Physics and Science Teacher (August 2007– June 2011)

Kuper Academy, Kirkland, QC

**Taught science high school courses:** Physics (Grade 11), Physical Science 436 and 416 (Grade 10) and Science and Technology (Grade 8). **Started and organized a Peer Tutoring program**, joining over 30 student-tutors with students requiring tutoring. Organized and mentored students for the Science Fair. **Organized and supervised physics and chemistry labs** as well as many innovative projects in the grade 8 Science and Technology class.

### Biology and Science Teacher (January 2006 – June 2006)

Royal West Academy, Montreal, QC

**Taught science high school courses:** Biology, Enriched Biology and Physical Science 436 (Gr. 10 & 11). **Organized a Marine Biology trip** to St. Andrew's, New Brunswick for 40 students. **Organized & supervised biology dissection and chemistry labs.** Invited speakers to present in class.

### Math and Science Teacher (Sept. 2005 – Dec. 2005)

St. Francis Xavier High School, Edmonton, AB

**Taught mathematics and science high school courses:** Pure Math 10 and Science 10.

**Director (Oct. 2004 – June 2005)***Beaumont Learning Centre, Beaumont, AB*

**Started and managed tutoring centre.** Attracted a wide range of students from elementary school children through junior and senior high. Ran many programs including one on one tutoring, small group instruction, final exam /diploma review sessions. Employed several tutors, pairing up the right tutor for each student and program. Coordinated teaching plans based on conversations with students, parents and the students' teachers. Organized marketing and advertising to attract students. Managed administrative matters such as payroll and hiring new instructors.

**Mathematics and Science Teacher (Sept. 2002 – May 2004)***New Horizons School, Sherwood Park, AB*

**Taught math, science, and options** (drama, art, outdoor ed, communication technology) to the junior high school gifted students. Developed the gifted program for junior high math and science. Improved and organized the science laboratory. Introduced Science Fair to the school and sent projects to the city-wide fair – two students received top honors (gold medal) and several other awards at the Edmonton Regional Science Fair. Led a Science Olympics team and created teams to participate in several math contests. Started many clubs, including the computer programming club and yearbook club.

**Director (Feb. 2001 – June 2002)***Equilibrium Math Centre, Calgary, AB*

**Started and ran a tutoring centre.** Attracted a wide range of students, from elementary school children, through junior and senior high, to adult upgrading and college students. Employed several tutors, pairing up the right tutor for each student and program. Managed administrative matters such as payroll and hiring new instructors.

**Math and Science Teacher (Feb. 2001 – June 2002)***Equilibrium Int. Education Institute, Calgary, AB*

**Taught mathematics and science high school courses** to international and adult students. Prepared students for provincial diploma exams. Improved the chemistry lab. Organized many extracurricular activities, such as two school-wide table tennis tournaments, chess club and many outdoor-education field trips.

**Mathematics Teacher (Sept. 2000 – Jan. 2001)***Solomon Learning Institute, Edmonton, AB*

**Taught mathematics courses:** Math 30 (grade 12 diploma math course) and Math 31 (grade 12 calculus course) to international students. Prepared students for the provincial diploma exams.

**Mathematics Teacher (Sept. 2000 – Jan. 2001)***St. Albert High School, St. Albert, AB*

**Taught mathematics courses:** Math 30 (grade 12 diploma math course) at the night school. Most students were retaking this course with the intention of increasing their grade on the provincial diploma exam. Had enormous success with the improvement of provincial diploma exam scores of the students.

**Education****Ph.D. in Educational Research – Learning Sciences Specialization (July, 2022 – Present)***Werklund School of Education, University of Calgary*

- The Doctor of Philosophy Education Research degree prepares scholars for leadership careers in research and teaching. Students engage with established and emerging ideas in the theory and practice of pedagogy, leading to comprehensive and specialized understanding of their area of study. The Learning Sciences specialty is an interdisciplinary field of scholarship that works to further scientific, humanistic, and critical theoretical understandings of learning as well as to engage in the design and implementation of pedagogical innovations to support learning.
- My proposed dissertation will examine how visualization and embodied cognition can elevate the sense-making of quantum physics in high school physics classes.
- I was awarded the Social Sciences and Humanities Research Council (SSHRC) doctoral fellowship in May 2023 – May 2027
- **Proposed Title of Dissertation: *An Embodied Approach to Teaching Quantum Physics.***
- Overall GPA 4.0/4.0 (so far)
- Awarded the **SSHRC doctoral fellowship** (2023 – 2027) - for a total of \$80,000.
- Supervisor: **Renowned Spatial Reasoning Scholar – Dr. Brent Davis**
- Several research assistantships: *Math Minds Project, Robots and Mathematical Reasoning, Board Games and Spatial Reasoning.*
- Teacher assistantship for a Natural Sciences course: SCIE 331
- Instructor: *Bioengineering Summer Institute 2023: ENG 100*

## M.A. in Educational Psychology – Learning Sciences Program (September 2009 – May 2011)

McGill University, Montreal

- The Learning Sciences Stream focuses on the study of learning as it occurs in real-world situations and ways in which learning may be facilitated in designed environments. The Learning Sciences are dedicated to the preparation of qualified researchers, developers, and practitioners who can advance the scientific understanding and practice of teaching and learning as they happen in both formal and informal settings.
- My thesis examines how visual representations aid in learning and teaching science, based on the Cognitive Load Theory. An empirical study of 180 high school students investigated whether students learn better by constructing their own diagrams as opposed to learning from a pre-constructed diagram.
- **Title of Thesis: *Learning from Visual Representations through Cognitive Load Theory.***
- Overall GPA 4.0/4.0
- Awarded the **Provost's Entrance Scholarship** and the **Principal's Fellowship**
- Research Assistantship with esteemed Dr. Krista Muis
- Empirical research on students' and teachers' epistemic beliefs, motivation, and various knowledge representations in math, science.
- Articles published and presented at Canadian and international conferences

## B.Ed. After Degree - Secondary Mathematics Major (September 1998 – May 2000)

University of Calgary

A unique teaching degree program, based on contemporary educational philosophies. By linking theory and practice this two year after-degree program prepares teachers to fulfill the obligations of an educator. These obligations include: understanding learners and learning, establishing an appropriate learning climate, organizing and implementing curriculum, evaluating learning and communicating effectively. Participated in two teaching practicums and a community workplace experience. Focused on teaching high school mathematics and educating gifted students.

- **Masters of Teaching Program**
- Obtained the Alberta Interim Teaching Certificate; after two years of teaching experience, received the **Alberta Permanent Teaching Certificate (2002)**
- Obtained the Quebec Teaching Permit: **Permis d'enseigner** from M.E.L.S. (2006)

## B.Sc. with Distinction - Physics and General Mathematics Double Major (September 1994 – May 1998)

University of Calgary

- A well-rounded physics degree with emphasis on mechanics, mathematical methods, thermodynamics, statistical mechanics, quantum mechanics, theory of relativity, electromagnetic theory, modern physics, electricity and magnetism, optics, and laboratory methods.
- The general math degree highlighted linear methods, calculus, differential equations, complex analysis, differential geometry, information theory, error control, abstract algebra, probability, statistics, and computer programming.
- The two majors mesh well together and serve as an excellent basis for a math and science teacher or for future academic endeavors.
- Dean's List each year
- Overall GPA 3.75/4.0
- Awarded the **Silver Medallion for Mathematics** based on top G.P.A. ranking among mathematics graduates of June 1998
- Received numerous scholarships including:
  - the **Canada Scholarship in Science** (all 4 years of the bachelor's program)
  - the **Louise McKinney Post-Secondary Scholarship**
  - the **Wilfred Archibald Walter Bursary**
  - the **Alexander Rutherford Scholarship**
  - the **University of Calgary Matriculation Merit Award**
  - the **Nickel Family Foundation Bursary**
  - the **Calgary Board of Education Academic Bursary**;the scholarships were based on academic achievement and community involvement. Over \$20,000 total in scholarships for the 4 years of my undergraduate degree.

## Scholarly Activity

### Refereed contributions

Gierus, B. & Davis, B. (in press). The Hyperlinked Visual-Spatial Map as a Novel Way to Explore an Academic Discipline. *Emerging Perspectives: Interdisciplinary Graduate Research in Education and Psychology*.

Francis, K., Davis, B., & Gierus, B. (2023). "Uczyć się" in *Metaphors of Learning in Different Languages*. <https://doi.org/10.11575/8B7N-V637>. <https://learningmetaphors.com>

Laycraft, K. C., & Gierus, B. (2019). *Acceptance: The key to a meaningful life*. Nucleus Learning.

Muis, K. R., & Gierus, B. (2014). Beliefs about knowledge, knowing, and learning: Differences across knowledge types in physics. *Journal of Experimental Education*, 82, 408-430

Muis, K. R., & Gierus, B. (2014). Beliefs about knowledge, knowing, and learning: Differences across knowledge types in physics. *Journal of Experimental Education*, 82, 408-430

### Refereed conference contributions

Francis, K., Davis, B. & Gierus, B. (2023, April). *Using robots to develop mathematical objects-to-think-with*. Poster presented at Coding, Computational Modelling and Equity in Mathematics Education Symposium, Brock University, ON.

Muis, K. R., Duffy, M., Foy, M. J., Trevors, G., Ranellucci, J., Gierus, B., & Wang, X. (2012, April). *Examining the nature and validity of epistemic beliefs using cognitive interviewing*. In K.R. Muis (Chair), Conceptual and methodological issues and advances in research on epistemic beliefs. Paper presented as part of symposium at the annual meeting of the American Educational Research Association, Vancouver, BC.

Muis, K. R., Foy, M. J., Duffy, M., Trevors, G., Ranellucci, J., Wang, X., & Gierus, B. (2012, April). *Testing the TIDE: Relations between teachers' and students' epistemic beliefs across high school, college, and university*. Paper presented at the annual meeting of the American Educational Research Association, Vancouver, BC.

Muis, K. R., & Gierus, B. (April, 2011). *Testing the TIDE: Differences across knowledge representations in physics*. Paper presented at the American Educational Research Association, New Orleans, LA.

Laycraft, K. & Gierus, B. (2010, July). *Emergence of Creativity and the Teaching Profession*. Paper session at the Ninth International Congress of the Institute for Positive Disintegration in Human Development, St. Charles, IL.

Laycraft, K. & Gierus, B. (2010, May). *Chaos Theory and the Process of Learning*. Paper session at the Fifteenth CSSE Annual Conference, University of Concordia, Montreal, QC.

### Non-refereed contributions

Francis, K., Lai, H., Gierus, B., Mah, P. (2023, February), *Boardgames Expand the Possibilities* [Conference presentation]. In-person live session Calgary City Teachers Convention 2023, AB.

This workshop for teachers was held during the biggest teacher convention in Alberta. The research on board game play of elementary students and how it influences spatial reasoning was presented along with strategies to include board games in grade 5 and 6 classrooms.

Gierus, B. J. (2011). *Learning with Visual Representations through Cognitive Load Theory*. McGill University (Canada).

This is my Master's Thesis. This work has been cited 1 time, according to Google Scholar, although it has not been published apart from McGill University archives.

Gierus, B. (2008, September). Eye on Alberta: Changing Schools, Montreal. *Alberta Views*, 11(7), 16-25(20).

This was an article I wrote for a magazine on the differences between Alberta and Quebec schools from a personal perspective.

Gierus, B. & Gierus, A. (2007) *The First Book of Hexa-Trex Puzzles*. Montreal, Canada

I created these Hexa-Trex puzzles (spatial-math puzzles), and besides having them published in several puzzle magazines, I also wrote this book filled with these puzzles.

## Other Experience

### Science Fair Coordinator - St. Luke Elementary School (2022 – 2023)

- organized the school Science Fair for the first time again after the pandemic.
- met with students throughout the year every 2 weeks to help with scientific method
- arranged for judges and decided on students to represent the school at the Calgary Youth Science Fair

### AMS/NOAA Summer Workshop - Project Atmosphere (2019)

- training of a cadre of master atmospheric education resource teachers who will assist the American Meteorological Society in training other pre-college teachers on atmospheric and related topics
- the development and implementation of scientifically accurate and pedagogically sound instructional resource materials for teachers.
- I was selected as the only Canadian participant in 2019.
- After the workshop, I trained other science teachers in my school on the content from the workshop

### Physics 30 Item Writing – Government of Alberta – Department of Education (2015 – 2021)

- Wrote Physics 30 diploma questions used in future Diploma Exams
- Validated Physics 30 diploma exams
- Worked with physics teachers from the entire province of Alberta

### Nucleus Learning (2006 – Present)

- Created an educational website, [www.nucleuslearning.com](http://www.nucleuslearning.com) designed to organize my own thoughts on teaching and learning math and science, to help other teachers with new ideas for their classes/projects, updating an educational blog regularly, sharing ideas, lesson plans and project ideas.

### Hexa-Trex Puzzle (2007 – Present)

- Developed a new type of math puzzle called Hexa-Trex. Originally, the puzzle was designed with math students in mind, practicing arithmetic and spatial visualization. Published a book of Hexa-Trex puzzles.
- The puzzle was published in several Games and Puzzle magazines, and was featured in an article by the *West Island Chronicle*.
- Developed Hexa-Trex app for iOS and android devices.

### Montreal Regional Science Fair Judge (March 2011)

- Judged high school science fair projects evaluating creativity, presentation, scientific method.

### Calgary Youth Science Fair Judge (March 1996, April 1997, April 1998, March 1999, March 2000, March 2021)

- Judged elementary school science fair projects evaluating creativity, presentation, scientific method.
- Second round judging, deciding on awards for finalists.

### Calgary Regional Computer Programming Competition Judge (May 1994, 1996, 1997, 1998)

- Judged computer projects and the problem solving challenges.
- Judge coordinator for junior high category: organizing judges, deciding on category winners from the finalists.

## References

Dr. Brent Davis – my current PhD supervisor: [abdavi@ucalgary.ca](mailto:abdavi@ucalgary.ca)

Dr. Krista Muis – my Master's thesis supervisor: [krista.muis@mcgill.ca](mailto:krista.muis@mcgill.ca)

Dr. Krista Francis – my research assistantship professor through my first year of Ph.D.: [kfrancis@ucalgary.ca](mailto:kfrancis@ucalgary.ca)

Dr. Beatriz Garcia-Diaz – laboratory coordinator at Webber Academy: [bgarcia-diaz@webberacademy.ca](mailto:bgarcia-diaz@webberacademy.ca)