



A G.A.T.E.WAYS JOURNEYS PROGRAM

for Years 5 and 6 children

with a love of engineering and mathematics

'Bridging the River Frothing'

G.A.T.E.WAYS is an independent organisation offering challenging and enriching activities and experiences to develop and extend highly able children. This JOURNEY will run over four sessions

Several centuries ago the small village of Frothing Grove was established along the banks of the River Frothing. With the passage of time, the population grew, and the village extended across the river to the bank on the opposite side. The villagers soon tired of rowing their boats 400 metres from one side to the other to visit friends and families and to trade goods, so a simple wooden footbridge was built across the river. Rapidly, the village expanded into a town and is now a thriving city. With its growth came many engineering challenges: upgrading and modernising infrastructure, sporting facilities, and of course catering for an increasing number of tourists. The city council called for tenders for these many projects and as a group of newly graduated engineers you were very keen to win the contract and establish yourselves in the workforce. Armed with mathematical wizardry and enthusiasm for building models, you are about to enter the history books with an engineering wonder of the 21st Century!

Session 1: Swinging Across the River

As the village grew into a town, the wooden bridge became congested with a constant stream of people visiting relatives and friends, while farmers struggled to get their produce to the markets. The town councillors decided to have a cable car built for the day-trippers to free up the bridge for the trades people. This session requires working with ratios, forces, gears and ingenuity as you construct an attractive working model of a cable car to solve the town's problem. This is not as simple as it may sound though! A complex integration of mathematics, effective planning and engineering must be the driving force as you aim to pull off the perfect pulley system!

Session 2: Towering over the River

The town grew even larger and became a popular tourist attraction, with visitors often drawn to the beautiful views across the River Frothing. Over time though, the trees along its banks obscured much of the outlook from the current viewing platforms. So, the council decided to erect a tower with viewing platforms jutting out from its sides. Designing this structure requires experimentation with different geometric shapes for building a solid and tall design that doesn't collapse in strong winds. This session calls for an understanding and appreciation of the surrounding city features but also an investigation into the physics and mathematical measurements involved in the forces that enable the platforms to withstand heavy mass.

Session 3: A Sporting Venture

Having grown into the largest city in the county, Frothing Grove became the centre of many of the region's activities including a wide range of sports. For many years the townspeople had been coming to the open ground outside the city for their annual inter-district events, but the grounds were no longer large enough. With its cold and wet winters and uncomfortably hot summers, something had to be done about the lack of modern facilities. During this session you will experiment with strong and flexible structures, scale diagrams, Pythagoras, geometric and algebraic formulas and the physics of upward and downward pressure as you plan and build the models to offer a solution for the Frothing Grove residents.

Session 4: Strong and Flexible

Now Frothing Grove is a busy, demanding metropolitan city. It has been a long time since the cable car became a tourist attraction, and it no longer provides for the city folk. Regional trains come into the city hub and trams transport people around the central business district. But travelling from one side of the river to the other has always been difficult and there is an urgent need to replace the old wooden bridge with one that can accommodate trains, motor vehicles and pedestrians; one that is strong enough for possible future expansions at each of its sides. This session requires you to build a bridge with a difference. You will apply different geometric volume formulas for two very different design features: heavy trains must travel along a straight route and pedestrians on a separate plane. This will involve managing the forces of sideways, upward and downward movement, as well as complex mathematical linear measurements and formulas. But wait! You must present it to the city council for appraisal, validating your design decisions and convincing the town's major stakeholders that this construction will be a bridge for the future of Frothing Grove!

Assessment and Reporting

Assessment will be based on an evaluation of each student's participation in the lesson activities. A self-assessment will also be completed. At the end of the program a short, written report will be completed on each student and forwarded to parents and schools.

Requirements

Please bring an exercise book (at least A5 size), a well-stocked pencil case (grey lead pencils, pens, some colours, a ruler, scissors, eraser, sharpener and glue), a protractor, set of geometry compasses and a scientific calculator.

Each week bring a nut-free snack, your hat and a drink bottle. All items should be clearly labelled with your name.

Please also provide a stamped, self-addressed DL envelope and a labelled photograph to assist with generating and sending your report at the completion of the Journey.

Homework

Your homework will be to research the structure of the Sydney Harbour Bridge and Brunel engineering projects. Small homework tasks may be set between sessions.

About the presenter:

Katrina Sims has a master's degree in Gifted Education. She established a Gifted and Talented program in a Primary School in the ACT in which she taught for fourteen years and for which she was awarded a National Excellence in Teaching Award in 1998. Katrina has been a member of the Australian Mathematics Challenge Committee since 1999 and was awarded a Bernard Neumann Award for Enrichment Mathematics in 2009. She retired from teaching at the end of 2010 after teaching students from years 3 to 12 in government, catholic and independent schools but still maintains an interest and concern for education of gifted students. Over the years Katrina has presented workshops to teachers in Australia and overseas on gifted education and middle school mathematics and was a committee member of the ACT Gifted and Talented Association.

