



WHITE PAPER

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Maths-Whizz[®]
by whizz EDUCATION

HOW VIRTUAL TUTORING SUPPORTS SPECIAL EDUCATIONAL NEEDS AND DISABILITIES (SEND) STUDENTS

For the UK the SEND Code of Practice 2014, the Teachers' Standards (2011) and OFSTED all clearly state that meeting the needs of all learners, including those with SEND, is first and foremost the responsibility of the class or subject teacher.





EXECUTIVE SUMMARY

Children might often find maths challenging and tricky at times. Mathematical skills such as counting, problem-solving, and mental arithmetic can sometimes be even more difficult for children with Special Educational Needs and Disabilities. As Educators and parents, we know finding the appropriate maths programme can be a trial and error process as what is right for one child may not be for another. When this decision is also compounded by the child having Special Educational and/or Disabilities Needs, being forearmed at the onset can help us to make intuitive and informed choices, essential to overcoming their specific barriers and building a positive attitude towards maths. We know how important it is to tailor the learning process to each individual child's needs. There are numerous considerations. Some of these are explored with explanations on how our differentiated virtual tutoring service, Maths-Whizz, can be used within these different contexts, like identifying gaps, motivation, developing memory, a multi-sensory approach, and essential tips on how these considerations can be implemented.



Maths-Whizz is the award-winning virtual tutoring service created by Whizz Education to raise standards in mathematics. The Maths-Whizz Tutor simulates the behaviour of a human tutor. It systematically embeds core knowledge and skills by individualising the learning journey according to each child's needs and pace of learning. The Tutor provides scaffolded support to ensure each student is appropriately guided throughout the whole lesson. As the Tutor interacts with the student online, it automatically captures their learning interactions and feeds back real-time reports to the parent and the teachers, which they can use for lesson planning and monitoring.

As we all know, mathematics is an activity - something we do - not a collection of facts and ideas that we must try to remember. So often, students with identified specific Special Educational Needs and/or Disabilities (SEND) will experience specific traits and behaviours that hinder or halt their progress in maths. Having a unique insight into their difficulties and known barriers for a particular categorised type of special need will then help you understand and appreciate their needs more. Armed with the information, you will have knowledge of how this impacts their ability to do basic mathematics. We summarise some of the known traits within some of the categorised SEND, with guidance on implementing Maths-Whizz to ensure the child can maximise their maths learning to their full potential. These examples are not comprehensive or exhaustive. They are intended to stimulate thinking rather than offer detailed advice on how to teach the subject to students with different types of Special Educational Needs and/or Disabilities. For example, a student with dyslexia may experience difficulties with decoding maths terms, notation, and symbols. When using Maths-Whizz, we suggest

- A visual crib sheet with mathematical terms, notations and symbols explained to use alongside the Maths-Whizz lessons may support decoding and understanding.
- Ensure the student gets the opportunity to rehearse mathematical vocabulary before the Maths-Whizz lesson.

And let's not forget what we want for all children is to build a love of maths, the Maths-Whizz animated lessons are engaging with a bit of humour, perfect for showing children that struggle with maths that it can be fun after all!

Maths-Whizz is an online Maths Tutor for 5 – 13-year olds designed to support high-quality teaching and learning for all students and, therefore, can be used to deliver individualised lessons to match each student’s needs, guiding them at their own pace, as well as, to support whole-class teaching.

The Maths-Whizz Tutor works like a human tutor. The Tutor assesses each student’s unique strengths and areas for improvement by guiding them through a low-pressure, interactive and adaptive initial assessment. It then calculates an overall Maths Age as the average. The Tutor uses the student’s learning profile to plan their unique learning journey, which is constantly updated depending on the progress they make.

Students love the Maths-Whizz lessons because they breathe life into maths. The lessons engage the student interactively through the animated representations displayed, there is a teaching section where the concept or method is explained and then interactive exercises which is a set of questions to practice the new learning. The Tutor automatically provides confidence-boosting prompts and scaffolded support. When a student inputs a wrong answer, help is provided which prompts the student with a reminder of the underlying method or concept, even intervening to take the student back to foundational material if they struggle. By targeting weaker topics without neglecting strengths, the Tutor accelerates maths progress and fills in the gaps in knowledge.

Maths-Whizz also fosters independent learning, through the student engaging with the Tutor each week to reach weekly goals, rewards and personal messages. The experience is built on gamification dynamics: students earn credits as they complete lessons, which they can spend in the Play Zone. Credits are the currency of reward in Maths-Whizz, providing students with powerful motivation to drive their effort and achievement. Credits are awarded to students based upon their performance in an exercise or test. The Weekly Tutoring

Map gives students access to lessons in Tutor, their Play Zone and other features such as Topic Challenge, messages and more. Students have the option of a jungle or space theme. The Weekly Tutoring Map allows students to track their short term learning for the week; they are encouraged to achieve at least 3 Progressions each week to improve their Maths-Whizz status. Students can click on their avatar to see their ranking.

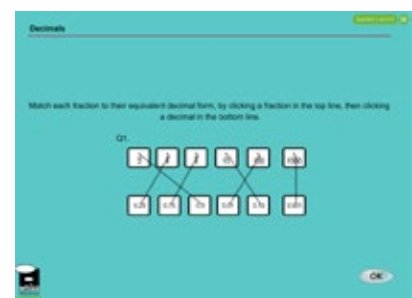
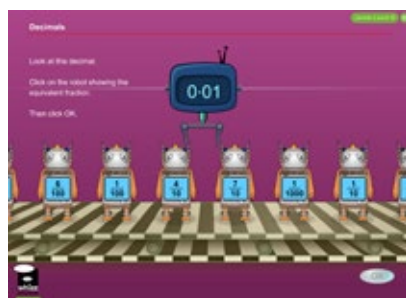
It is important to recognise that the individual mathematical difficulties of a student are specific and unique. Maths-Whizz personalisation ensures long-term support in the classroom but could also be used to support intervention programmes. The student’s lesson history can be accessed by teachers to ascertain how the student is progressing and intervene further with additional support where appropriate.

This section explains how Maths-Whizz can support the teaching and learning. To make mathematics lessons inclusive, teachers need to anticipate what barriers to taking part and learning particular activities, lessons or a series of lessons may pose for students with particular SEND. When planning the teacher needs to consider ways of minimising or reducing those barriers so that all students can fully take part and learn. In some activities, students with SEND will be able to take part in the same way as their peers. In others, some modifications or adjustments will need to be made to include everyone.

TEACHING SECTION

INTERACTIVE EXERCISE

TEST



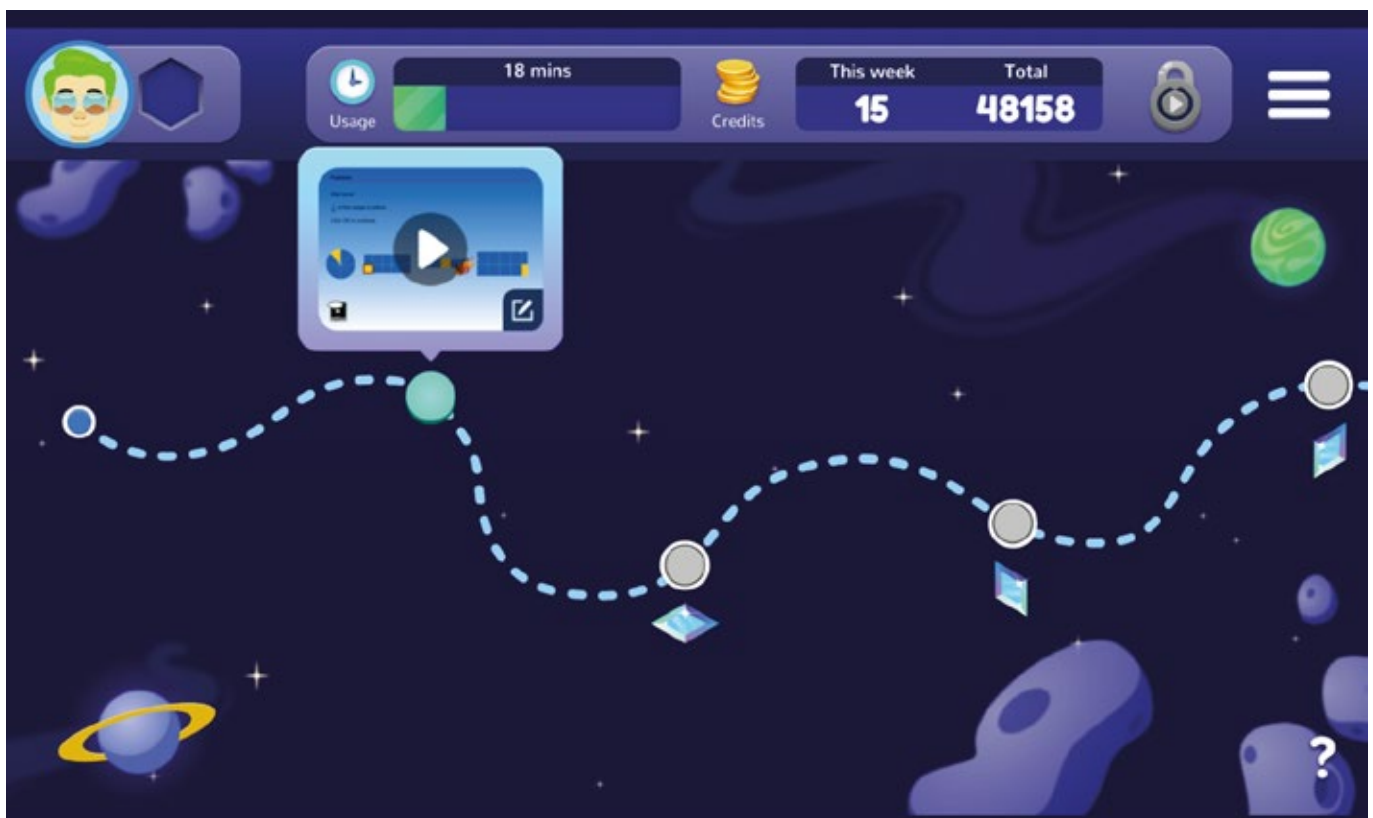
Tips



- Ensure the student completes the initial assessment unaided
- Depending on the level the student is working at in Maths, when they register their date of birth may have to be adapted so the assessment isn't set to high initially
- Split the 60 minutes into smaller manageable chunks over the week
- Check progress in the student's lesson history including areas of weakness, strengths, usage, time in Tutor
- In lesson history identified areas of weakness could be supported further with additional adult support
- Ensure the child spends time in Tutor and uses Topic Challenge to consolidate

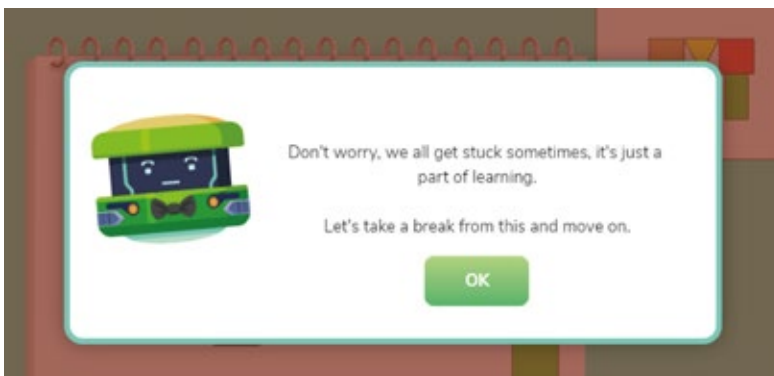
INCLUSIVE LEARNING ENVIRONMENT – IDENTIFYING GAPS AND REMOVING BARRIERS

An all-inclusive learning environment meets the needs of all students. This can be challenging for the teacher when there is a range of needs and students need to access the learning at different points. Some students with SEND experience difficulties with key aspects of mathematical learning and these difficulties form a barrier to the student's progress. Diagnostic tests can identify Mathematical barriers, but these can be lengthy, and the teacher still has to plan sessions to address the learning gaps. With Maths-Whizz the student completes an initial assessment designed to identify their current knowledge level across different topics. The assessment guides students through several topics and pinpoints their level in each topic by giving them a series of short tests. The assessment is adaptive: the questions get harder if the student gets them right and easier otherwise. The student is set a Maths Age for each topic. The assessment usually covers 4-10 topics; it isn't practical to assess students in all 22, so the Tutor makes a 'best guess' on the unassessed topics, ignoring those it thinks are too easy or too advanced for the student based on the results achieved in the assessed topics. It then calculates an overall Maths Age as the average. Maths-Whizz is inclusive of all students, matched to the pace of each learner and really supports removing barriers.



APPROPRIATE SUPPORT

Often the teacher can be challenged with how to deploy themselves and other adults in the lesson to support the learning. The learning needs to be broken down into small progressive steps, to build on understanding but it's not always possible to guide and support each student. Maths-Whizz Tutor adapts to the student and to how they are accessing the learning. When a student fails an exercise, they are taken to a remedial lesson that fills their knowledge gap. Every exercise has an assigned regression lesson. Students can also 'Jump Backwards', where they are automatically sent to regression after struggling with the first few questions. The Tutor can 'regress' up to two lessons backwards. If a student is perpetually stuck on this final lesson, it is advised that parents/teachers intervene.



MULTI-SENSORY APPROACH

Many students learn best through a multi-sensory approach. Multi-sensory teaching techniques and strategies stimulate learning by engaging students on multiple levels. They encourage students to use some or all their senses. Some students who have SEND may rarely attend to their visual environment as they may be affected by difficulties with tracking or visual processing. The solution for these difficulties is to involve the use of more of the student's senses, especially the use of touch (tactile) and movement (kinetic) so they may need to be taught or guided on how to focus on the Maths-Whizz lessons. Be aware of 'visual overload' for some students. Foundation to year 2 lessons have auditory support and animated prompts.



Tips

- If a student keeps answering questions incorrectly then it is worth administering a reset and to get the student to do a re-assessment
- The student's Lesson History will show how a student is progressing
- The student may need additional support to understand a concept, this will need to be delivered off screen
- Topic Focus could be set for an individual student on a selected topic for 3 progressions



Tips

- Give the students plenty of time to complete the teaching and exercises, maybe limit the number of lessons to aid processing of information
- Be creative with ways to involve different senses
- Designating a maths area in the classroom to stimulate thinking and make connections with the current learning on Maths-Whizz helps maximise real life situations particularly with some of the more practical areas of maths like time, fractions, geometry

INVOLVING PARENTS AND STUDENTS IN COMMUNICATION AND REVIEWING

Maths-Whizz Online Tutor can be accessed between home and school, so students can practise at any time. Parents can instantly understand their child's true level of ability – strengths and weaknesses, monitor progress and give encouragement. Students can also look at the mathometer to check their progress on their dashboard.



Tips

- Set up Maths-Whizz parents workshops so they have the opportunity to familiarise themselves with the resource
- Invite parents to celebration assemblies
- Each parent can have full visibility on their child's progress via Parent Dashboard App
- Teacher and parent can access the same reporting data, so this could be used at parent meetings

MOTIVATION / ATTITUDE – CELEBRATING SUCCESS

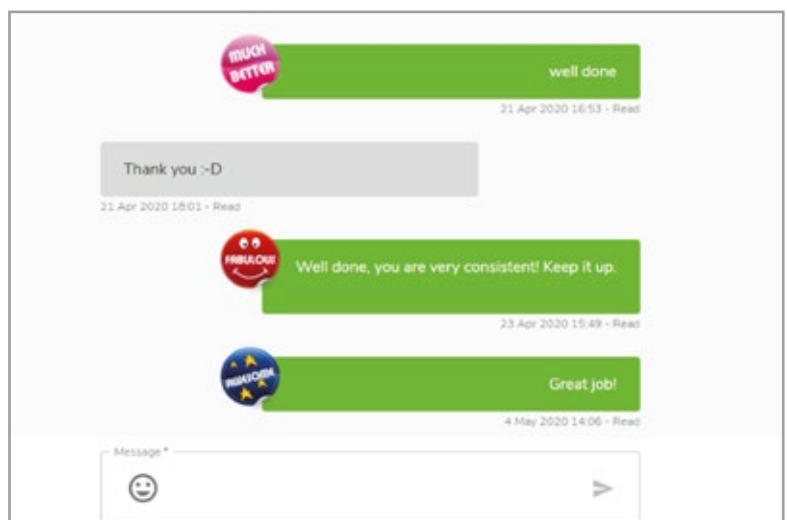
Attitude and motivation play a key part in students enjoying maths and 'having a go'. Some students from prior experience can have a fixed mindset 'I can't do it'. This can inhibit their progress and perpetuate anxiety. Some students get 'maths anxiety' not just from being wrong, but from incomprehension about how and why they are wrong.

The Tutor keeps adapting to their needs, pushing every student to reach their potential with weekly goals, rewards and personal messages. This can really support SEND students with motivation or attitude issues. It keeps them motivated and supports retention – keeping the knowledge and skills simmering.



Tips

- Ensure students spend time in the tutor to be awarded the credits - it's based on time and performance in the exercises and tests
- Involve parents as well in celebrating success - send motivating messages with fun stickers
- Celebration assemblies are a fantastic collaborative way of celebrating success
- Students experiencing anxiety may need sustained emotional support as they work by sitting with them
- Ensure weekly timetable schedules are visual and rewards have been set. Use Maths-Whizz weekly planner



MEMORY / CONSOLIDATION

The Maths-Whizz Tutor makes sure each student is secure in their understanding before moving them to new material. Students acquire new knowledge in Tutor, and they can consolidate knowledge in Topic Challenge.

Topic Challenge gives them access to lower-age exercises, down to $\frac{3}{4}$ years in each topic from where they currently are in Tutor as well as allowing students to complete exercises already passed in Tutor. This encourages them to increase their performance (score and speed). Students can earn medals for improving their Topic Challenge really supports SEND students who need to revisit areas of mathematical learning frequently. performance in these lessons.



Tips

- Get students to spend some time in Topic Challenge each week to aid retention
- The visual learning might need to be supported with kinaesthetic experiences
- Visualising and verbalising are key to the successful use of working memory so engaging in mathematical conversations and use of mathematical vocabulary help with understanding and recall of what they have been working on

METACOGNITION

Maths-Whizz helps support metacognition in helping the student become aware of their strengths and weaknesses and can motivate them to engage in and improve their learning. The majority of students with SEND can develop some degree of metacognition, however, this is not something that struggling mathematicians pick up and specific learning-to-learn strategies will need to be specifically taught. Evidence suggests that teaching metacognition and self-regulation strategies are particularly effective with lower achieving student, Maths-Whizz helps support this, by personalising the maths learning, focusing on the areas of weakness, scaffolding support, giving opportunities for students to consolidate these areas through Topic Challenge and celebrating success.

“Metacognition and self-regulation approaches aim to help pupils think about their own learning more explicitly, often by teaching them specific strategies for planning, monitoring and evaluating their learning. Interventions are usually designed to give pupils a repertoire of strategies to choose from and the skills to select the most suitable strategy for a given learning task.”

Metacognition and self-regulated learning
Education Endowment Foundation 2018



Tips

- Model some of the strategies used in the teaching section to support the learning
- Talk with the student about how they are doing and how they could improve - use their mathometer as a visual. You could even show Topic bars in Reports so they can visually see their progress
- Look at the mistakes they are making and ensure they have a system in place to ask for help

ASSESSMENT

The Maths-Whizz Tutor keeps adapting lessons to each student as they progress. Using continuous, behind-the-scenes assessment - based on answers given, time taken, and the level of encouragement needed - the Tutor monitors progress to keep providing the right lesson at the right time in maths. The Maths-Whizz Reporting gives you the results instantly. Every moment learning with the Tutor is actually a formative assessment in maths. Maths-Whizz Reporting gives the teachers access to up to date live data, which they can use for lesson planning, monitoring and target setting. The student can view their progress within a topic in Topic Challenge.

Tips



- Plan time with the student to discuss the incremental progress they are making - regular positive feedback supports a growth mindset
- Important to track student's progress in lesson history and address any errors or misconceptions in any particular topics immediately
- Get the students to take more responsibility and ownership by engaging with the dashboard regarding usage progressions achieved weekly



PARTICULAR ISSUES THAT RELATE TO SPECIFIC SEND CATEGORIES

This section explores the particular issues that can relate to the specific SEND categories and suggests possible extensions and emphases that may be helpful in removing barriers for students with SEND in mathematics and ICT. These examples are not comprehensive or exhaustive. They are intended to stimulate thinking rather than offer detailed advice on how to teach the subject to students with different types of Special Educational Needs and/or Disabilities. This section explores the particular issues that can relate to the specific SEND categories and suggests possible extensions and emphases that may be helpful in removing barriers for students with SEND in mathematics and ICT. These examples are not comprehensive or exhaustive. They are intended to stimulate thinking rather than offer detailed advice on how to teach the subject to students with different types of Special Educational Needs and/or Disabilities.

AUTISM SPECTRUM DISORDER (ASD)

Autism spectrum disorder (ASD) is a neurological and developmental disorder that begins early in childhood and lasts throughout a person's life. It affects how a person acts and interacts with others, communicates, and learns. It includes what used to be known as Asperger syndrome and pervasive developmental disorders. ASD is a continuum which means some students may have mild difficulties whilst others may have profound difficulties. Number, in terms of learning sequences, counting and calculating, can be a strength for many students with ASD. They can have a good memory for number order and sequences but can struggle to grasp abstract concepts.



- The initial assessment may need to be completed in chunks in a time frame achievable to the student.
- Make sure the student is familiar with the structure of Maths-Whizz - Direct teaching, exercise, test. This could be represented visually in a schedule to make the Tutor session structure clear.
- The questions in exercises and tests are numbered so the student knows which question they are currently on and how many more to complete, making the beginning and end of task clear, avoiding ambiguity.
- The use of timers clearly labelling how long the session will last gives the student a definitive end point, these could be used alongside Maths-Whizz to split the lessons into manageable chunks.
- Time in Topic Challenge will help build positive engagement in learning and enables students to revisit areas of mathematical learning frequently.
- Teachers can gain an insight to the student's learning through lesson history, from this the teacher can offer practical support for difficult areas of maths learning.
- Create a workstation or space with low level distraction to complete the Maths-Whizz lessons.
- As some students with ASD can be oversensitive or under-sensitive, the use of headphones can also help to support their sensory needs.
- It is important to remember that students with ASD sometimes find bright and colourful displays over stimulating and may cause raised anxiety levels, refusal to co-operate and/or challenging behaviour. Depending on the behaviours exhibited may depend on the level of exposure students have of Maths-Whizz. We need to be realistic.
- Ensure a consistent approach to Maths-Whizz between home and school by involving the student and their family.

DYSCALCULIA

Signs of dyscalculia aren't always easy to spot, and it isn't the same as maths anxiety, but students with dyscalculia often react strongly to activities that involve maths and will become upset or frustrated. Students diagnosed with dyscalculia have a specific learning difficulty for mathematics. This is characterised by having difficulty understanding simple number concepts, lacking an intuitive grasp of numbers, and having problems learning number facts and procedures. Even if they produce a correct answer or use a correct method, they may do so mechanically and without confidence. The key to supporting the learning of a student diagnosed with dyscalculia lies in the identification of their strengths. Maths-Whizz Tutor initial assessment will capture this.

- Maths-Whizz also fosters independent learning, through the student engaging with the Tutor each week to reach weekly goals, rewards and personal messages. Praise, rewards and encouragement is key to boost confidence and motivation.
- Time in Topic Challenge will help build positive engagement in learning and enables students to revisit areas of mathematical learning frequently to reinforce concepts learnt.
- Ensuring Maths-Whizz is part of the maths curriculum and timetabled in supports the student familiarity and structure of the resource.

DYSLEXIA

In maths, students with dyslexia may experience difficulties with decoding maths terms, notation, symbols. They may also struggle to understand the language surrounding the maths questions

- Initially, the student may need support in going through a lesson, this lesson can then be completed again independently through Topic Challenge.
- Encouraging the student to have a pen and pad jot down key facts whilst they are working through the Maths Whizz lessons may support learning and retention.
- A visual crib sheet with mathematical terms, notations and symbols explained to use alongside the Maths Whizz lessons may support decoding and understanding.
- Encourage the student to verbalise what they are doing and learning on Maths-Whizz.
- Ensure the student gets the opportunity to rehearse mathematical vocabulary before the Maths-Whizz lesson (pre-teaching). This can be accessed in school reports under the curriculum tab.

The British Dyslexia Association states that:

50 – 60%
OF DYSLEXIA STUDENTS
EXPERIENCE DIFFICULTIES IN
MATHS



10%
EXCEL AT MATHS

MODERATE LEARNING DIFFICULTIES

(Suggestions here are also likely to apply to Severe and profound and multiple learning difficulties if Maths-Whizz is applicable)

A student with Moderate Learning Difficulties (MLD) has significant delay in reaching developmental age-related expectations and is likely to have difficulty with basic literacy and mathematics, however, each student has their own strengths and weaknesses unique to them.

- Maths-Whizz enables the tutor to deliver an individualised learning plan tailored to each student's specific knowledge gaps, which is constantly updated depending on the progress they make.
- It is important for the student to revisit areas of mathematical learning frequently, students with MLD often need to overlearn specific areas and this can be accessed through Topic Challenge.
- The animations are engaging with clear teaching and instruction keeping the student's attention.
- The questions in the exercises and tests are numbered so the student knows which question they are currently on and how many more to complete, making the beginning and end of task clear, avoiding ambiguity.
- Direct teaching with visual clues are scaffolded into the Maths-Whizz lessons to support the learning.

MOTOR AND ORGANISATIONAL NEEDS (INCLUDING DYSPRAXIA)

Students with motor and / or organisational needs may experience difficulties with higher order reasoning and thinking skills, self-regulation (to behaviour / attend in appropriate socially acceptable ways), sensory processing, attention, concentration and motivation.

- Have Maths-Whizz timetabled in to establish routine.
- Math-Whizz is broken up into short lessons, the student knows how many more questions to complete and the lesson can be stopped and continued at another time.
- Maths-Whizz enables students to practice through Topic Challenge to help learn and retain previous learning.
- There is a clear structure in to using and navigating Maths Whizz to support independence and organisational skills
- Foundation to year 2 lessons have auditory support and animated prompts.
- Encourage the student to verbalise what they are doing and learning on Maths-Whizz.
- Encourage eye tracking by pointing with a finger so the student can see where to look to help focus and highlight key parts of the screen.

SENSORY NEEDS

Not all students that have sensory needs will have learning difficulties, but some materials and resources will have to be adapted to enable the student to have access.

Hearing Needs:

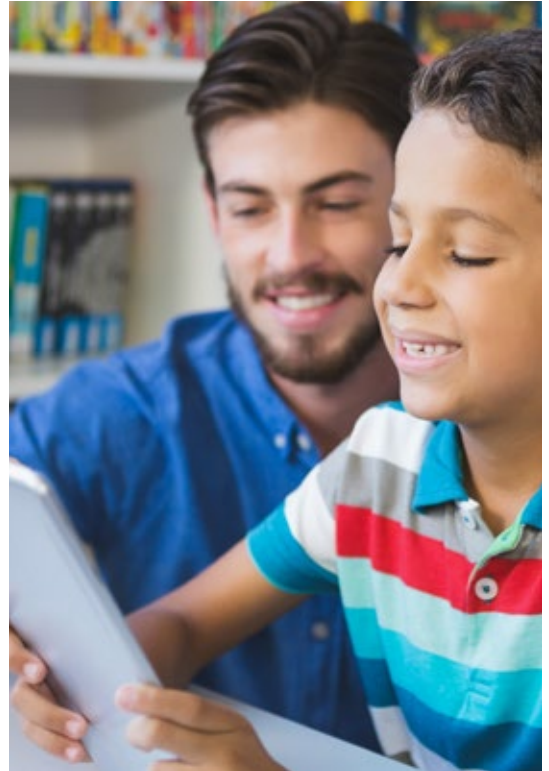
- Maths-Whizz has written instructions as well as an auditory, so students will be supported in accessing the materials. Initially it might be helpful for the student to have extra support in the form of someone signing key terms or to explain the auditory effects.

Visual Needs:

- Depending on the student's visual needs, Maths-Whizz may not be appropriate to use.

SPECIFIC CONDITIONS

Students who have a specific condition for example, Down syndrome (DS or DNS), also known as trisomy 21, is a genetic disorder caused by the presence of all or part of a third copy of chromosome 21. It is usually associated with physical growth delays, mild to moderate intellectual disability, and characteristic facial features, or cerebral palsy, may well present with characteristics of one or more of the special needs detailed in SEND categories listed.



SPECIFIC LEARNING DIFFICULTIES

Specific learning difficulties affect the way information is learned and processed. They are neurological and can have a significant impact on learning for example short term memory, sequencing, working memory, long-term memory, metacognition, attention, listening or even numerosity.

Students with specific learning difficulties cannot be generalised in terms of support and the support will need to be on individual needs basis. The suggestions under the other SEND categories may be helpful.

SPEECH, LANGUAGE AND COMMUNICATION NEEDS (SLCN)

Students who have problems with understanding and using words are likely to have difficulties in mathematics. In most Maths-Whizz lessons the animation is supported with written and audio prompts, to aid understanding.

- In Maths-Whizz the mathematical language and language of instruction should match the level of the student's understanding as the Tutor continually assesses their understanding.
- Give students time to process the information in Maths-Whizz and support by repeating the instruction through reading or signing.
- If the student is struggling with a lesson, the Tutor automatically provides confidence-boosting prompts and scaffolded support, even intervening to take students back to foundational material if they struggle.

Approximately 20 percent of the school population is defined as having Special Educational Needs and Disabilities (SEND). Some of these students will also have learning difficulties linked to social deprivation and some students with special educational needs will also have disabilities. The learning difficulties encountered are often, but not always, associated with literacy and numeracy development and are sometimes aggravated by missed or interrupted schooling, perhaps due to long-term medical conditions. In many cases, students' needs will be met through appropriate intervention including the differentiation of tasks and materials.



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