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TEACHING AND LEARNING MATHEMATICS RESEARCH SERIES II: *Effective Intervention Strategies*

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TABLE OF CONTENTS

BACKGROUND AND RATIONALE

Mathematics is an essential part of preparing our students for a successful professional and personal life (European Commission, 2013); however, there is concern that Canadian students' mathematical achievements are on the decline (EQAO, 2012). As discussed in the first brief, *Teaching and Learning Mathematics Research Series l: Effective Instructional Strategies,* in 2012, the Programme for International Student Assessment (PISA), an international study examining 15 year old students' mathematical performance, showed that math scores in Ontario have declined by 16 points over that last nine years (EQAO, 2012; as cited in Sinay and Nahornick, 2016). This brief will go hand-in-hand with the *Teaching and Learning Mathematics Research Series l: Effective Instructional Strategies* brief to present evidence-based mathematics interventions to help address the challenge of students struggling in mathematics. The interventions outlined are based on meta-analyses, best-evidence synthesis, education reviews and research briefs from national centers of education in the United States, Australia, European Union, and United Kingdom. There are many intervention strategies discussed in this brief, but with all the interventions there should be a shared commitment to the intervention program for it to be successful.

What is an intervention?

Interventions are additional supports for students who are at risk of falling behind, or for students who are preforming below standards (National Center for Excellence in Teaching Mathematics, 2011).

What are effective intervention strategies in mathematics?

There are many different research-informed intervention strategies in mathematics. Table 1 details 19 different intervention strategies in mathematics, including information on the research that informed the recommendation. The Office for Standards in Education (OfSTED) (2009) explains there is no single intervention strategy that will solve the issue of low performing mathematics achievement. Rather, success comes from ongoing, continued intervention programs that are targeted to students' needs, assess students regularly, monitor student progress, are well-managed by administrative staff, and are implemented by highly trained and knowledgeable staff (OfSTED, 2009). The following 19 intervention strategies can be categorized into three broad areas:

1. Intervention Methods
2. Instructional Strategies
3. Staff Interventions

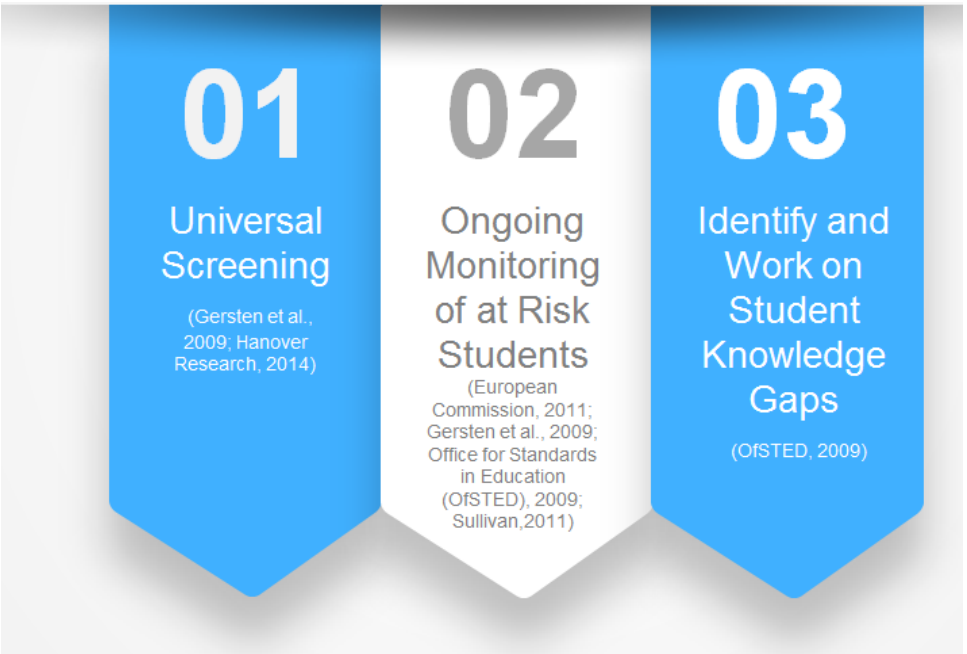
Figure 1: The Foundation of Effective Intervention Strategies

*Based on OfSTED, 2009

Following is a summary of intervention strategies that fall within the three broad intervention areas. Please note, the instructional strategies and interventions marked with an asterisk (*) are discussed in greater detail in Research Series I. For more details of all interventions, please refer to Table 1.

1. Intervention Methods
   a. Universal screening (Gersten et al., 2009; Hanover Research, 2014)
   b. Ongoing monitoring of at-risk students (European Commission, 2011; Gersten et al., 2009; Office for Standards in Education (OfSTED, 2009; Sullivan,2011)
   c. Identify and work on student knowledge gaps (OfSTED, 2009)

Figure 2: Intervention Methods



2. Instructional Strategies
   a. Maintain high expectations (OfSTED, 2009; Sullivan, 2011) (*discussed in Research Series 1)
   b. Explicit and systematic instruction (Gersten et al., 2008; Gersten et al., 2009; Hanover Research, 2004; NCTM, 2007; Sullivan, 2011)
   c. Instruct on problem-solving (Gersten et al., 2009) (*discussed in Research Series 1)
   d. Teach with visual representations (Gersten et al., 2008; Gersten et al., 2009; NCTM, 2007)
   e. Use a range of examples (Gersten et al., 2008)
   f. All grades should include 10 minutes of arithmetic practice per day (Gersten et al., 2009; Hanover Research, 2014) (*discussed in Research Series 1, see section on Develop Mental Mathematics Skills)
   g. Teach mathematics in a multidisciplinary and interdisciplinary manner (European Commission, 2013) (*discussed in Research Series 1, see Give Meaning to Mathematics through Science, Technology, Engineering and Mathematics)
   h. Use monitored high-quality small group instruction when necessary (OfSTED, 2009; Sullivan, 2011) (*discussed in Research Series 1, see section on How to Implement Successful System Wide Interventions)
   i. Incorporate culturally sensitive curriculum and teaching (Sullivan, 2011)
   j. Provide learning disabled students feedback on their effort (Gersten et al., 2008)
   k. Use cross-age peer assisted tutoring (Gersten et al., 2008)

Figure 3: Effective Instructional Intervention Strategies

3. Staff Interventions
    a. Ensure teacher knowledge of mathematics and intervention strategies (European Commission, 2011; Gersten et al., 2009; National Center for Excellence in Teaching Mathematics, 2011; OfSTED, 2009) (*discussed in Research Series 1, see section on Be Knowledgeable about Mathematics in regards to Early Childhood Educators)
    b. Establish clear directions by administrators (OfSTED, 2009)
    c. Maintain school support of intervention programs (OfSTED, 2009)
    d. Recognize teacher efforts in combating low mathematics achievement (European Commission, 2013)
    e. Push for greater parental and community engagement (European Commission, 2013) (*discussed in Research Series 1, see section on Building Positive Attitudes in Mathematics)

Figure 4: Staff Interventions

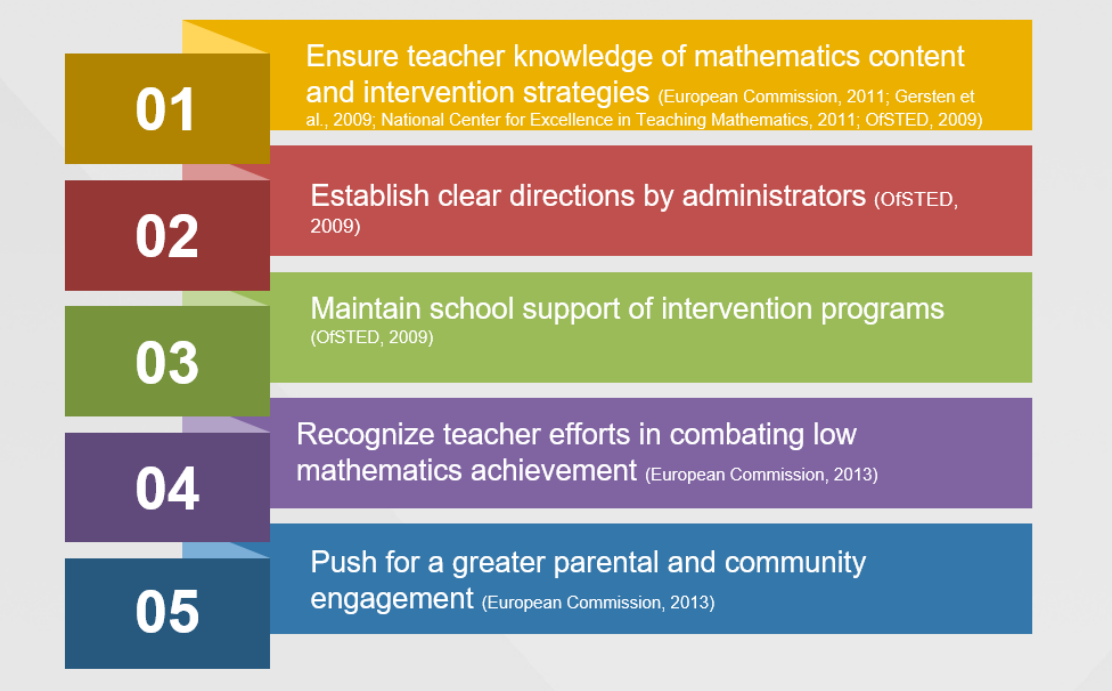


Table 1: Details on Effective Intervention Strategies in Mathematics

Intervention Strategy	Details	Research-informing Evidence	Discussed in Research Series 1
1. Universal screening	**Screen ALL students** to identify potentially at-risk students. Screening should take place at the beginning and middle of the school year.	(Gersten et. al, 2009; Hanover Research, 2014)	No
2. Ongoing monitoring of at-risk students	At-risk students' progress should be **continually monitored**, and their assessment data should be communicated to teachers. Assessment should focus on curriculum objectives and material covered.	(European Commission, 2011; Gersten et al., 2009; Office for Standards in Education (OfSTED), 2009; Sullivan,2011)	No
3. Identify and work on knowledge gaps	It is paramount to identify and secure at-risk and low performing students' **knowledge gaps**. These areas should be the focus of intervention.	(OfSTED, 2009)	No
4. Maintain high expectations	Self-concept is a key factor in mathematics learning. Low achieving students often have a low self-concept in mathematics. Students and teachers should **set and maintain high expectations** in mathematics where students are pushed to challenge themselves.	(OfSTED, 2009; Sullivan, 2011)	Yes
5. Use explicit and systematic instruction	Intervention instruction for low achievers should be explicit with teacher modeled, **step-by-step instruction**, with multiple opportunities for students to ask and answer questions. Additionally, students should be encouraged to think aloud.	(Gersten et al., 2008; Gersten et al., 2009; Hanover Research, 2004; NCTM, 2007; Sullivan, 2011)	No
6. Instruct on problem-solving	Teach students to **problem-solve** by teaching the underlying structures of problems.	(Gersten et. al, 2009)	Yes
7. Teach with visual representations	Use **visual representations** such as number lines, graphs, arrays, drawings when teaching and learning mathematics. Higher gains have been observed when the teacher and students both uses visuals in mathematics.	(Gersten et al., 2008; Gersten et al., 2009; NCTM, 2007)	No
8. Use a range of examples	Use a careful selection of **examples** to highlight a variety of skills and concepts.	(Gersten et al., 2008)	No
9. All grade levels should include 10 minutes of arithmetic practice per class	Research has shown low performing students often struggle with arithmetic. Interventions at all grade levels should include **daily practice of arithmetic**.	(Gersten et al., 2009; Hanover Research, 2014)	Yes

Intervention Strategy	Details	Research-informing Evidence	Discussed in Research Series 1
10. Teach mathematics in a multi-disciplinary and inter-disciplinary manner	Mathematics should be taught in context of other disciplines.	(European Commission, 2013)	Yes
11. Use monitored high-quality small group instruction when necessary	When a student is very far behind and whole class instruction is not feasible, small group tutoring can be an option.	(OfSTED, 2009; Sullivan, 2011)	Yes
12. Culturally sensitive curriculum and teaching	Use characteristics of students' culture to inform pedagogy and curriculum materials. Students should feel they have a place in the classroom.	(Sullivan, 2011)	No
13. Provide learning-disabled students feedback on their effort	Studies have shown **feedback on effort** had the largest impact on learning-disabled student achievement.	(Gersten et al., 2008)	No
14. Cross-age peer assisted tutoring	Use of cross-aged peer assisted tutoring has better outcomes than same age peer assisted tutoring.	(Gersten et al., 2008)	No
15. Ensure teacher knowledge of mathematics and intervention strategies	Educators should have a **sound knowledge of mathematics and its pedagogy**. Educators should be thoroughly trained and provided with ongoing and monitored professional development.	(European Commission, 2011; Gersten et al., 2009; National Center for Excellence in Teaching Mathematics, 2011; OfSTED, 2009)	Yes
16. Establish clear directions by administrators	Senior leaders should ensure all parties (principals, teachers, assistants, etc.) are given **clear directions** and are on board with intervention protocols.	(OfSTED, 2009)	No
17. Maintain school support of intervention programs	Intervention programs require **continued support** and efforts.	(OfSTED, 2009)	No
18. Recognize teacher efforts in combating low mathematics achievement	There should be **recognition efforts** such as prestige, increased pay, or career advancement for teacher efforts to improve low mathematics achievement	(European Commission, 2013)	No

Intervention Strategy	Details	Research-informing Evidence	Discussed in Research Series 1
19. Greater parental and community engagement	There should be a **greater emphasis on parental and community involvement** in mathematics education.	(European Commission, 2013)	Yes

What barriers exist in implementing the recommended research-informed intervention strategies?

There are a variety of barriers that exist when implementing intervention strategies in math, but as previously mentioned, intervention strategies are more likely to succeed when there is a shared commitment to the success of the intervention program (National Center for Excellence in Teaching Mathematics, 2011). The main implementation barriers are: time, resources, staff knowledge/training, issues with communication, low expectations, and inaccurate metrics to measure improvements (National Center for Excellence in Teaching Mathematics, 2011). Table 2 details the 19 intervention strategies outlined in Table 1 with explanations of barriers to interventions and recommendations for dealing with the barriers.

Figure 5: Main Barriers to Implementation

*Based on (National Center for Excellence in Teaching Mathematics, 2011)

Table 2: Details on Barriers to Intervention and Evidence-based Recommendations

Intervention	Barriers to Intervention	Recommendations
1. Universal screening	School boards and schools may find it **difficult to allocate time** for universal screening (Gersten et al., 2009). Some people might question why we are testing students who are doing fine (Gersten et al., 2009).	**Create screening teams** (i.e., teachers, assistants, trained older student, etc.) to screen students quickly and efficiently (Gersten et al., 2009). Screening all students ensures students are on the right track, and students who are at-risk are not being missed (Gersten et al., 2009).
2. Ongoing monitoring of at-risk students	Assessment data may be collected too late (such as the end of the year).	Students at-risk should be assessed early and continuously. **Assessment** should especially take place **at the beginning and middle of the year** (Gersten at al., 2009).
3. Identify and work on knowledge gaps	Assessments do not correctly identify knowledge gaps (OfSTED, 2009).	Intervention strategies are much less effective when assessments do not correctly identify knowledge gaps. Student assessments should assess curriculum objectives and material covered in class (OfSTED, 2009).
4. Maintain high expectations	Sometimes educators teaching at-risk or "lower stream groups" have low expectations for students and do not truly believe the students can learn the content (Sullivan, 2011).	Educators must set **high goals** for all students and challenge students (Sullivan, 2011).
5. Use explicit and systematic instruction	Some educators **may not be familiar with teaching pedagogy** related to explicit and systematic instruction (Gersten et al., 2009). Some educators may not have the mathematical content knowledge to fully explain underlying mathematics concepts (Gersten et al., 2009).	Districts and schools should provide ongoing and high quality professional development on teaching pedagogy including lesson observations (Gersten et al., 2009). Districts and schools should provide in-depth professional development on mathematical content (Gersten et al., 2009).
6. Instruct on problem-solving	Teachers may be unfamiliar with how to incorporate problem-solving into their mathematics teaching (Gersten et al., 2009).	Students should be working on word problems continually, ideally multiple times a week (Hanover Research, 2004).

Intervention	Barriers to Intervention	Recommendations
7. Teach and learn with visual representations	Curriculum materials may include only a few examples of visual representations (Gersten et al., 2009). Some educators may feel using visual representations such as manipulatives takes too much time (Gersten et al., 2009). Some educators may not fully understand the mathematics behind the visual representations (Gersten et al., 2009).	You may have to use a variety of curriculum materials or develop your own (Gersten et al., 2008). Manipulatives use should not be overemphasized and their use should be curated (Gersten et al., 2008). Districts and schools should provide in-depth professional development on **mathematical content** (Gersten et al., 2008).
8. Use a range of examples	Curriculum materials may include only a select number of examples (Gersten et al., 2009).	Use a variety of curriculum materials to incorporate a variety of examples to highlight different skills and concepts (Gersten et al., 2008).
9. All grade levels should include 10 minutes of arithmetic practice per class	Students might find practicing arithmetic every class **boring** (Gersten et al., 2009). Curricular materials may not include sufficient activities (Gersten et al., 2008).	Try to make **arithmetic practice fun**, using games, flashcards, or apps (Gersten et al., 2008). You may have to use a variety of curriculum materials (Gersten et al., 2009).
10. Teach mathematics in a multidisciplinary and interdisciplinary manner	Some educators may not have the knowledge to teach mathematics in a multidisciplinary and interdisciplinary manner (European Commission, 2013). Curricular materials may not include activities that teach math in an multidisciplinary and interdisciplinary manner.	Districts and schools should provide in-depth professional development on teaching in a multidisciplinary and interdisciplinary manner (European Commission, 2013). Government curricular materials should include activities that utilize a multidisciplinary and interdisciplinary manner (European Commission, 2013).
11. Use monitored high-quality small group instruction when necessary	Students are taught materials they already know; year-long small groups outside of the classroom may be ineffective (Sullivan, 2011).	Staff must be highly trained (OfSTED, 2009). Prior to small group tutoring, assessments must identify student knowledge gaps (OfSTED, 2009). There should be a clear intention that **small-group tutoring is not permanent**, and an exit strategy exists (Sullivan, 2011).

Intervention	Barriers to Intervention	Recommendations
12. Culturally sensitive curriculum and teaching	Curricular materials may not include activities that teach math in a culturally sensitive manner.	Districts and schools should provide materials that teach mathematics in a culturally sensitive manner.
13. Provide learning-disabled students feedback on their effort	Some educators may be unfamiliar with ways to provide appropriate feedback (European Commission, 2013).	Districts and schools should provide in-depth professional development on giving feedback in mathematics (European Commission, 2013).
14. Cross-age peer assisted tutoring	Logistically it may be challenging to assign cross-age peer tutoring. Students may not know how to effectively tutor.	Research has shown cross-age peer tutoring is more effective than same-age peer tutoring. Time should be spent setting up the logistics (Gersten et al., 2008). Schools should provide students with training on tutoring strategies.
15. Ensure teacher knowledge of mathematics and intervention strategies	Some educators may not be familiar with mathematics content knowledge or intervention strategies (Gersten et al., 2009).	Districts and schools should provide ongoing and high quality professional development on mathematics content and teaching pedagogy (Gersten et al., 2009).
16. Establish clear directions by administrators	Information is not shared to all parties involved (i.e., teachers, assistants, aids) (OfSTED, 2009).	Administrators must ensure directions on interventions are clear and understood by all. Meetings, professional development, and newsletters should focus on intervention measures and allow for opportunities to ask questions (National Center for Excellence in Teaching Mathematics, 2011).
17. Maintain school support of intervention programs	Sometimes educators feel that after new programs are introduced they lose support or are **forgotten about**.	Mathematics interventions are very important to address low achievement, and the programs should have **dedicated staff, program initiatives, clear directions, ongoing professional development, and educator buy-in** (European Commission, 2013). There should be a long-term commitment to supporting mathematical intervention programs.
18. Recognize teacher efforts in combating low mathematics achievement	Some educators may feel that they are trying very hard to implement intervention strategies to improve low mathematics achievement, but their **efforts are not recognized** (European Commission, 2013).	Educators should be **recognized for their efforts** through prestige, increased pay, or career advancement (European Commission, 2013).

Intervention	Barriers to Intervention	Recommendations
19. Greater community and parental involvement	Schools may not know how to increase parental involvement (European Commission, 2013).	Some suggestions include: increasing support and information for parents to facilitate increased involvement. This might include giving training to parents with low levels of education, having informal parental involvement (i.e., clubs, fieldtrips, etc.), or developing and disseminating materials for parents to help their children (i.e., math tutorials) (European Commission, 2013).

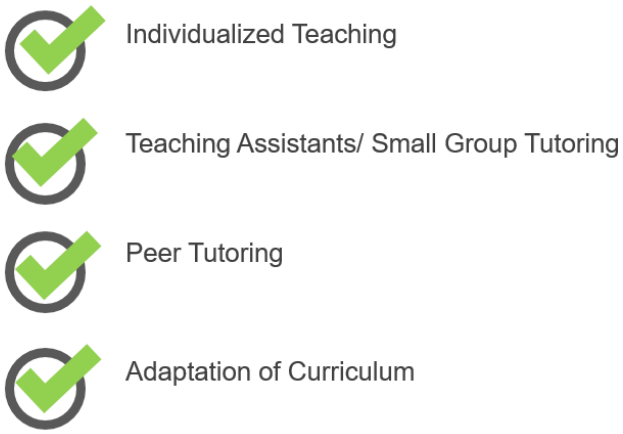
Mathematics interventions are very important to address low achievement, and the programs should have **dedicated staff, program initiatives, clear directions, ongoing professional development, and educator buy-in** (European Commission, 2013).

What are examples of interventions from other jurisdictions?

Different jurisdictions have different intervention policies. In some jurisdictions, a central educator authority, such as a Department of Education, prescribes intervention strategies for low achieving students. In other jurisdictions, central authorities provide general recommendations that educators can choose from, and still other jurisdictions have central authorities that do not provide any guidelines for supporting low achievers (European Commission, 2013). For example, in many parts of Europe (Estonia, Ireland, Spain, Poland, Norway), central authorities decide on intervention policy. In Scotland and Denmark, more general recommendations are provided, while in Czech Republic, Latvia, Hungary, Sweden, and Iceland no central recommendations are given and each school must decide what is best for them (European Commission, 2013).

The most typical supports provided to low achievers include: individualized teaching, teaching assistants, peer-tutoring, collaboration, and adaptation of curriculum (European Commission, 2013). Table 3 outlines a variety of examples of interventions from other jurisdictions.

Figure 6: Common Mathematics Interventions



*Recommendations Based on (European Commission, 2013)

Table 3: Details and Examples of Interventions from Other Jurisdictions

Intervention Strategy	Examples of Interventions from Other Jurisdictions
1. Universal screening	In Norway, the use of diagnostic tests, national tests, and early interventions are used as **screening for all students** to determine at-risk or low achieving students (European Commission, 2013).
2. Ongoing monitoring of at-risk students	In Poland, the Ministry of National Education created a program that **monitors at-risk and high-risk students** through early diagnosis of difficulties even in early childhood education and provides remediation and extra classes (European Commission, 2013).
3. Identify and work on knowledge gaps	In Ireland, identifying student knowledge gaps and providing **individualized teaching** are part of the learning supports provided to at-risk/low-performing students. As part of this, cooperative learning, one-to-one withdrawals, and team teaching are also used (European Commission, 2013).
4. Maintain high expectations	The European Commission (2013) emphasizes the importance of teachers setting and communicating high expectations for all students. In Sweden, the National Agency for Education points out that teacher expectation is an important factor in student motivation to learn mathematics (European Commission, 2013).
5. Use explicit and systematic instruction	The U.S. Department of Education recommends **regular explicit instruction** for struggling students. This is based on six randomized control trials of mathematics interventions (Gersten et al., 2009).
6. Instruct on problem-solving	In France, the United Kingdom, Ireland, Spain and Cyprus, problem-solving is the focus of the mathematics curriculum and an **area of explicit instruction** (European Commission, 2013).

Intervention Strategy	Examples of Interventions from Other Jurisdictions
7. Teach with visual representations	In Iceland, teachers are encouraged to teach with visual representation. This includes using videos, calculators, and computer programs to teach mathematical concepts (European Commission, 2013). The U.S. Department of Education recommends intervention teaching should include visuals (Gersten et al., 2009).
8. Use a range of examples	The U.S. Department of Education recommends using a range of example to teach different mathematical ideas (Gersten et al., 2008).
9. All grade levels should include 10 minutes of arithmetic practice per class	In the United States, there are a variety of numeracy intervention programs targeting arithmetic, including: Fraction Face-Off!, I CAN learn pre-algebra and algebra, and Do the Math (Hanover Research, 2014).
10. Teach mathematics in a multidisciplinary and interdisciplinary manner	In Estonia, Greece, France, Italy, Portugal, and the United Kingdom, mathematics curriculum focuses on **cross-curricular teaching** (European Commission, 2013).
11. Use monitored high-quality small group instruction when necessary	In France, the Ministry of Education allocates 2 hours per week for **small group or one-to-one teaching** (European Commission, 2013). In Spain, Ireland and Slovenia, small group tutoring is provided for **up to two hours after the normal school day**. In Spain, small group instruction is provided by university students or teachers. In Slovenia, mathematics teachers provide the remediation (European Commission, 2013). In Australia, the intervention *Extending Mathematical Understanding (EMU)* is a short program that includes tutoring for 6-7-year-olds on number learning (Sullivan, 2011).
12. Culturally sensitive curriculum and teaching	Australia's Council for Educational Research recommends using culturally sensitive curriculum and teaching to improve Indigenous mathematics achievement. For example, in Australia *The Garma* Mathematics Curriculum (2007) **incorporates Indigenous ways of knowing** in the mathematics curriculum (Sullivan, 2011).
13. Provide learning-disabled students feedback on their effort	The U.S. Department of Education recommends providing feedback to learning-disabled students on their effort (Gersten et al., 2008).

Intervention Strategy	Examples of Interventions from Other Jurisdictions
14. Cross-age peer assisted tutoring	In many EU nations, **peer tutoring is one of the most common practices** for supporting at-risk or low-achieving students (European Commission, 2013). The U.S Department of Education recommends using cross-age peer tutoring over same-age peer tutoring (Gersten et al., 2008).
15. Ensure teacher knowledge of mathematics and intervention strategies	In Belgium (French Community), Estonia, Lithuania and Liechtenstein, **student mathematics assessment data are used to inform teachers' professional development** learning mathematics content and intervention strategies (European Commission, 2013). In Denmark, teachers reported they found mathematical communication, problem-solving, and understanding the role of mathematics challenging and this information is used to create teacher training (European Commission, 2013). In Finland, the Ministry of Education maintains a **website for teachers with information on the most common student learning problems** in mathematics, computer instruction learning modules, and diagnostic tests. Teacher professional development is also free of charge (European Commission, 2013).
16. Establish clear directions by administrators	In France, the Court of Auditors published a detailed report on what works for low-achievers. They found that educators are often misinformed and use contradictory practices in relation to initiatives for low achievers. There **should be clear and precise objectives** and instructions provided (European Commission, 2013).
17. Maintain school support of intervention programs	In the United States, programs were found to be more effective when there were long-term commitments to the intervention strategies (Borman et al., 2003). Borman et al. (2003) conducted a meta-analysis on school reform including 232 studies and found that schools that implemented initiatives for **5 years or longer had better results**.
18. Recognize teacher efforts in combating low mathematics achievement	The European Commission (2013) recommends teachers should be recognized for their efforts in combating low mathematics achievement, even though few countries have such programs in place.

Intervention Strategy	Examples of Interventions from Other Jurisdictions
19. Greater parental and community engagement	In Ireland and Scotland, curriculum documents discuss the importance of informing parents of the terminology and methods used in mathematics learning (European Commission, 2013). In Latvia, a project called *Science and Mathematics* **connects schools with entrepreneurs** with organized activities and competition to increase student, parent, and societal enthusiasm for mathematics (European Commission, 2013). In Austria, Hungary, Slovenia and Spain, parents are **provided subsidies** or loans for purchasing textbooks for their children (European Commission, 2013). The European Commission (2013) reports having more mathematics books in the home can improve student achievement. In Greece, teachers are encouraged to **write letters to parents with details of student learning** and performance in mathematics and suggestions of at-home mathematics activities (European Commission, 2013).
20. Curricular Adaptation	In Spain, **minor curriculum adaptations** are made for students in primary and lower secondary who are achieving below curriculum standards (European Commission, 2013). In Scotland, all students are expected to meet curriculum expectations (European Commission, 2013).

Which interventions should be avoided?

There are some mathematics interventions that are not supported by research and should be avoided. Details on these interventions can be found in Table 4. The main interventions to avoid are:

1. grouping students by achievement (i.e., tracking or streaming) (Hattie, 2009; Sullivan, 2011),
2. continuous small group tutoring (Sullivan, 2011), and
3. only assessing students at the end of the year (European Commission, 2011), and mixed aged classes (Sullivan, 2011).

Figure 7: Interventions to Avoid

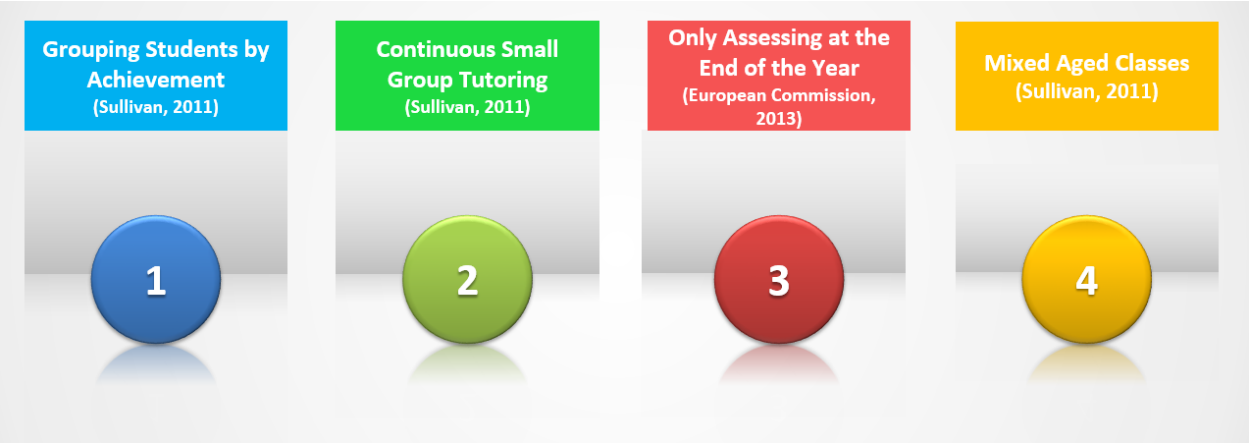


Table 4: Details on Interventions to Avoid

Interventions to Avoid	Reason	Recommendations from Other Jurisdictions
1. Grouping students by achievement	Many schools group students by achievement (i.e., tracking or streaming); however, **tracking has been found to have serious harmful effects on equity** and minimal effects on achievement. Additionally, grouping by achievement can greatly reduce future opportunities for students in lower groups. Instead, teachers should **differentiate teaching** planning for common learning experiences for all (Hattie, 2009; Sullivan, 2011).	Australia's Council for Educational Research recommends that grouping students by achievement should be AVOIDED, and that instead of grouping by achievement, classrooms should be made into a collaborative community with explicit instructions on why and how they will be learning, with well-thought-out tasks that allow for changes and extensions for those that need them (Sullivan, 2011).
2. Continuous small group tutoring	Small group tutoring can make **students feel isolated** and increase low self-concept in mathematics. Small group tutoring should be used only when necessary, for a specified and short time period with highly trained staff (Sullivan, 2011).	Australia's Council for Educational Research recommends that small group tutoring should only be used sparingly in the most necessary cases. Rather than use small group tutoring, educators should use explicit and direct instruction as a way to increase achievement in at-risk students (Sullivan, 2011).

Interventions to Avoid	Reason	Recommendations from Other Jurisdictions
3. Formally assessing students at the end of the year only	Students should be assessed as early as possible in order to provide timely and accurate interventions for at-risk students (European Commission, 2011).	In Bulgaria, they **use national test scores to develop resources for at-risk** and low-achieving students (European Commission, 2013).
4. Mixed aged classes	Especially at the primary levels, students should not be placed in mixed aged classes (Sullivan, 2011).	In Romania, they identified **mixed aged classes as a problem with low-achievement** and have discontinued this practice as of 2010 (European Commission, 2013).

Which successful intervention strategies could be implemented for success for all?

This research brief has discussed a variety of important research-informed mathematics intervention strategies. If we are to summarize our recommendations they are as follows:

1. Provide early, ongoing, and accurate universal student assessment (Gersten et al., 2009; Hanover Research, 2014)
2. Ensure intervention programs meet the exact needs of students (OfSTED, 2009)
3. Use explicit and systematic teaching (Gersten et al., 2008; Gersten et al., 2009; Hanover Research, 2004; NCTM, 2007; Sullivan, 2011)
4. Ensure teacher knowledge of content and intervention strategies (European Commission, 2011; Gersten et al., 2009; National Center for Excellence in Teaching Mathematics, 2011; OfSTED, 2009)
5. Maintain school support of intervention programs (OfSTED, 2009)

Nonetheless, all of the interventions discussed in this brief should be considered when creating mathematics intervention programming. The main reminder with mathematics intervention programming is that there should be a long-term and dedicated commitment to improving mathematics achievement and helping all of our students succeed in their mathematics learning.

Figure 8: Recommendations for Implementation

Table 5: Recommendations for Implementation

1. **Early, ongoing, and accurate universal student assessment** (Gersten et al., 2009; Hanover Research, 2014).
2. **Ensure intervention programs meet the exact needs of students with continual monitoring of student progress** (OfSTED, 2009).
3. **Use explicit and systematic teaching including using visuals, teaching problem-solving, using a range of examples, and practicing arithmetic every class with every grade** (Gersten et al., 2008; Gersten et al., 2009; Hanover Research, 2004; NCTM, 2007; Sullivan, 2011).
4. **Ensure teacher knowledge of mathematics and intervention strategies. Provide ongoing high quality professional development** (European Commission, 2013; Gersten et al., 2009; National Center for Excellence in Teaching Mathematics, 2011; OfSTED, 2009).
5. **Maintain school support of intervention programs, including clear directions from administrators and support and incentives for educators** (OfSTED, 2009).

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