PSYCHOLOGICAL FACTORS IN IMPROVING NUMERACY

EDUCATIONAL PSYCHOLOGY SERVICES

FORTH VALLEY AND WEST LOTHIAN REGIONAL IMPROVEMENT COLLABORATIVE

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https://blogs.glowscotland.org.uk/fa/epservice/how-we-work/research/
https://blogs.glowscotland.org.uk/glowblogs/fvwlric/psychology-and-numeracy-research-2019/
https://education.gov.scot/improvement

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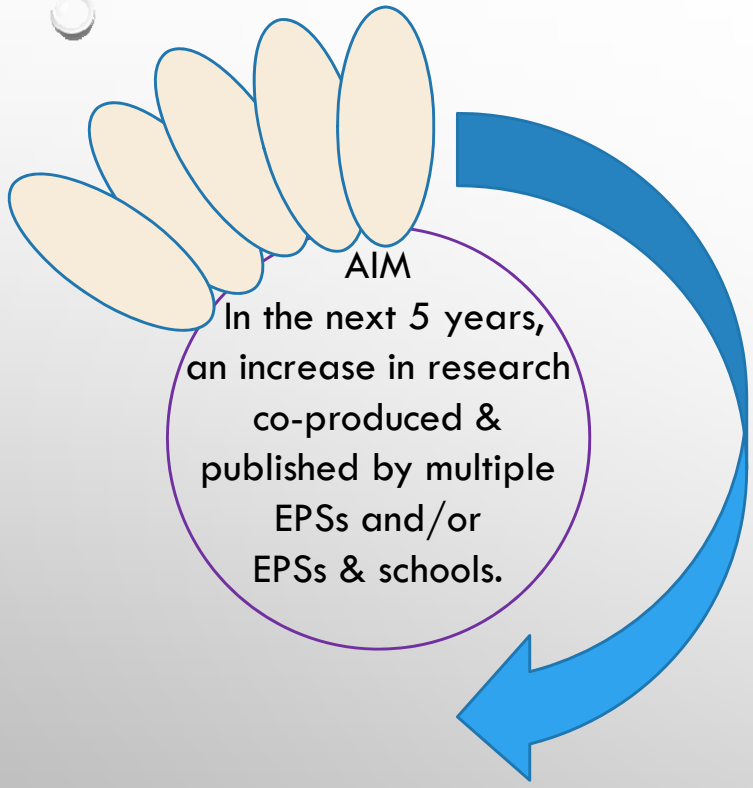
DISCUSSION POINTS

(using lotus blossom technique identifying potential interventions)



AIM

By the end of 2022, EPSs will have an enhanced role in developing the research infrastructure and the capacity of the education system to identify and use evidence.

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Early aptitude in numeracy is correlated with later outcomes (Duncan et al., 2007), not only in mathematics but also in literacy (Purpura, Hume, Sims, & Lonigan, 2011).

5 STUDIES ON NUMERACY

- Attachment and numeracy: a literature review
- Bridging the gaps: long term outcomes of an action research programme to improve numeracy
- Metacognition and numeracy: A 'thinking aloud' intervention in P3/4
- Pupil voice: views of national 5 pupils in relation to their experiences of numeracy skill development
- Psychological factors in promoting numeracy: a meta study

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Metacognition (P3/4) – 3 school based projects (N=40, T=8, n=15, t=3*)

- Metacognitive strategies are less utilised by children from deprived areas
- Metacognition strategies helpful in improving maths and used more as a result of the course
- Modelling aloud of metacognitive strategies is a promising intervention with young children

Bridging the Gaps – 4 school based projects (N=169/229*, T=10/18*)

- Teacher action research skill development leads to improved outcomes in numeracy and closing the poverty related attainment gap
- Assists in identifying and targeting multiple gaps in real contexts
- Schools need a **critical mass** of continuity for Improvement - culture and context that promotes long term relationship building and learning progression

Attachment and Numeracy – literature review

- Object permanence, risk taking, problem-solving, attention focus and teacher perception of competence all enhanced with secure attachments
- Correlation between SES and insecure attachment
- Encourage learning and pre-numeracy skill development in very early years (e.g. quantity)

Pupil Voice (S4) – across 8 high schools in LA (N=56)

- Pupils who were "struggling" had different views from those that were succeeding
- Liked working in similar ability classes and interactive or creative lessons
- Mindset, enjoyment and constructive feedback important

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META STUDY - METHOD

- EXPLICIT AIM AT OUTSET OF 4 PROJECTS
- JOINT SESSIONS OUTSIDE OF NATIONAL MEETINGS (X2) – 4 EPS PROJECT TEAMS
- PEP REGULAR MEETINGS (~8)
- CONTENT ANALYSIS OF 4 REPORTS
- IDENTIFIED FACTORS WITH PSYCHOLOGICAL BEARING
- GROUPED INTO THEMES/CLUSTERS
- IDENTIFIED THREE DOMAINS

LIMITATIONS

- RELIABILITY
- VALIDITY
- WEIGHT OR IMPORTANCE OF FACTORS
- PROCESS FACTORS
- MULTIPLE LAYERS OF PROJECTS/STUDIES

- OUTWEIGHED (PERHAPS BY VALUE OF META STUDY APPROACH)

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META-STUDY: 94 PSYCHOLOGICAL FACTORS, 21 CLUSTERS

Individual	Intersubjective	Contextual
Enjoyment and motivation	Prior relationship	Poverty
Early skills and knowledge	Teacher relationship	Leadership and culture
Prior Learning	Learning Activity	Continuity and sustainability
Emotional development and self-regulation	Pedagogy fit	
Math specific skills, knowledge and learning	Teacher led culture	
Attitudes and beliefs	Quantity/resource	
Purpose and relevance	Teacher practice	
Learning approach	Peer dynamics	
Developmental stage and age		

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RECOMMENDATIONS

- Promoting long term duration of teacher pupil relationships,
- Promoting whole school consistency and beyond in the teaching of mathematics
- Promoting the child's development of numeracy skills has multiple psychological factors
- Consider the impact that relationships and attachment style may have on pupils' numeracy development
- Ensure that teacher led innovations occur in a culture of learning, knowledge and research and with reference to the existing evidence base on effective interventions
- Encouraging parents to become more involved in contributing to the development of concepts skills and knowledge which are fundamental to math but not necessarily math specific such as risk-taking behaviour, metacognition, self-regulation and beliefs about intelligence and mastery.
- Actively encourage collective teacher efficacy in a context that promotes sustainability of improvement in evidence based ways.
- Debate about practice and improvement at a strategic and practice level
- **Cultural change with regard to numeracy education – secure funding for long term improvement**

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FIND THE REPORT

- https://blogs.glowscotland.org.uk/fa/epservice/how-we-work/research/
- https://blogs.glowscotland.org.uk/glowblogs/fvwlric/psychology-and-numeracy-research-2019/

SUMMARIES PUBLISHED ON

- https://education.gov.scot/improvement

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NATIONAL ACTION ENQUIRY RESEARCH & DEVELOPMENT

FORTH VALLEY & WEST LOTHIAN REGIONAL COLLABORATIVE AND EDUCATION SCOTLAND PARTNERSHIP

Falkirk Council
Children's Services

Educational Psychology Service

Practitioner Research 2016-2019

Bridging the Gaps: Mathematics and Numeracy

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What 'Bridging the Gaps' project is about? (Phase 1)

12 schools participated in action research programme (2016-17) designed and delivered by EPS. 4 discrete projects emerged in individual schools and clusters of schools.

- demonstrate an effective service delivery approach to enhance practitioner research skills focused on the identification on interventions to bridge attainment gaps in mathematics & numeracy

- extend the use of the coach consult methodology (Balchin, Randall & Turner, 2006; Randall, Turner & McLafferty, 2015) to attempt to transfer the success of this programme for the purpose of bridging attainment gaps.

- outcomes of phase one are provided in Morrison & McLafferty (2018). The conclusion was that this method or approach to service delivery can assist educational psychology services to build capacity, enhance practice and there was merit in the hypothesis that this was likely to improve attainment. It was found to be effective at improving teacher confidence and skills in action research.

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What 'Bridging the Gaps' project is about? (Phase 2)

Longitudinal analysis of pupil outcome data & school implementation factors

- demonstrate the impact on learners of the interventions implemented to bridge attainment gaps in mathematics and numeracy

- identify factors that supported or hindered the schools implementation of the research or pedagogical knowledge and skills covered in the programme

- provide meta analysis across the 4 Regional Improvement Collaborative EPSs – Stirling, Clackmannanshire, Falkirk and West Lothian.

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Methodology

Schools were responsible for applying the evaluation and data tracking skills they had been trained in. Schools asked to present the data to the Educational Psychology Service on individual children's progress in attainment and whatever else was measured as part of the project in their school at a follow-up point, 13 months after the end of the programme.

EPS team devised a consultation approach to discuss and gather the data. This involved:

- an invitation to a structured consultation and a request to bring their data
- a consultation conversation using the "Intervention Plan" devised within the Coach consult programme by the practitioners
- intervention population
- baseline data
- tracking data
- additional data

An opportunity to provide additional data to the EPS or second consultation meeting.

The EPS retained a copy of the school level data for the overall analysis.

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METHODOLOGY DISCUSSION

- RELIES ON PRACTITIONERS OWN RESEARCH DESIGN AND RESEARCH QUESTIONS
- NO SINGULAR MEASURE OF EFFECTIVENESS

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KEY THEORY – ATTAINMENT GAPS

- the concept of an attainment 'gap' is unhelpful, and the term attainment 'gaps' should be encouraged
- the term 'bridging' attainment gaps rather than 'closing' attainment gaps is preferred to reflect the incremental and long-term investment required
- methodical and systematic approaches are required to enhance data use and understanding to address attainment gaps
- skill development and close collaborations between managers and classroom practitioners in schools is required to address attainment gaps.
- identifying all gaps that exist across all stages within a school due to poverty and other factors is critical as is the endeavour to close gaps and raise the quality of teaching and learning overall for learners.

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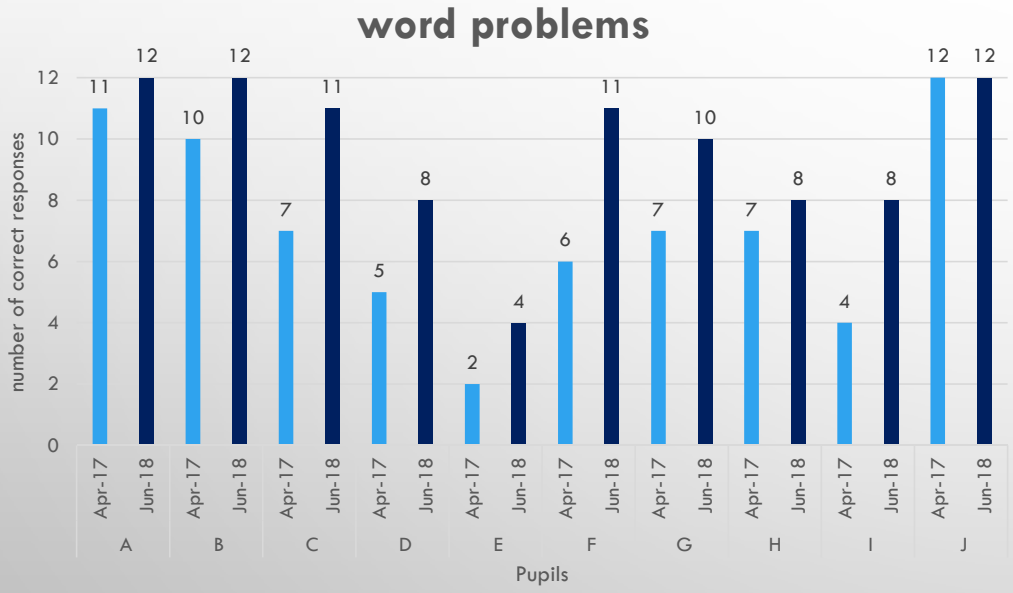
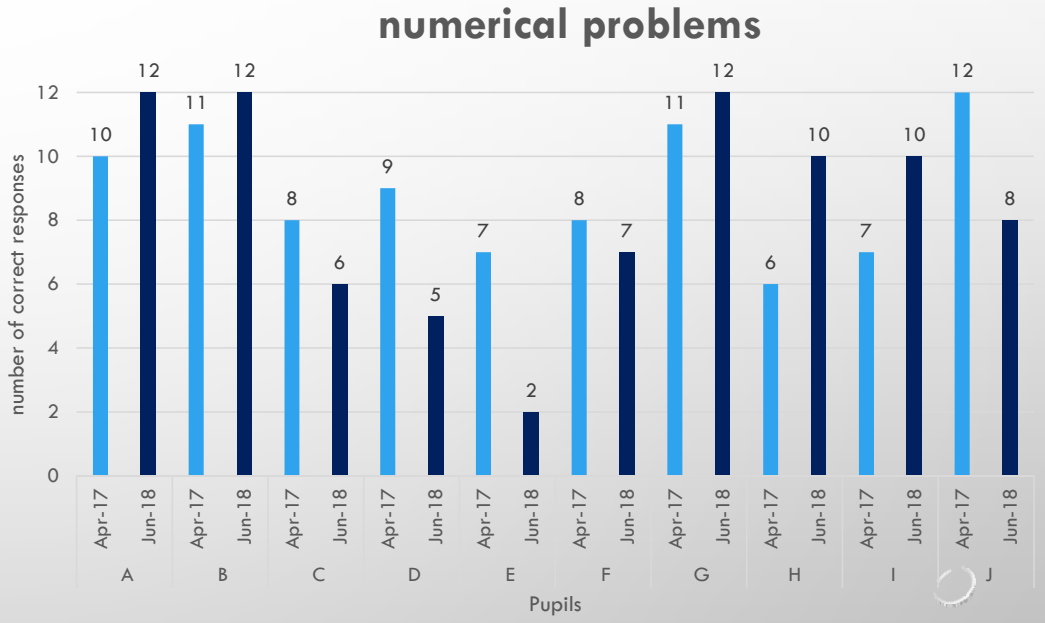
Key findings - Pupil level impact & outcomes

Individual school (10 children)

– intervention for mathematical vocabulary, reducing literacy barriers to numeracy and mathematical attainment.





9 children's scores increased

1 child retained 100%

5 children's scores increased

5 children's scores decreased

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Key findings - Pupil level impact & outcomes

Individual school (whole school data; Scottish National Standardised Assessments year 1) – intervention for mathematical vocabulary, reducing literacy barriers to numeracy and mathematical attainment.

SNSA 2017/18 NUMERACY (P1, 4, 7) FOR PROJECT B SCHOOL (MAY 2018)

		% low	% med	% high
School	P1	0%	13%	87%
Neighbourhood		1%	23%	76%
Falkirk		1%	26%	73%
School	P4	10%	46%	44%
Neighbourhood		12%	54%	34%
Falkirk		11%	51%	38%
School	P7	13%	65%	23%
Neighbourhood		6%	45%	49%
Falkirk		5%	39%	56%

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Key findings - Pupil level impact & outcomes

Cluster (7 primary schools & secondary school; 159 learners)
– using active learning pedagogy to support learners attitudes and skills in fractions.

CHANGE TO PUPIL SELF-EVALUATION

How good are you at fractions?		
Increase in rating	Decrease in rating	No change
73%	0%	27%

CHANGE TO PUPIL SKILLS AS MEASURED BY FRACTIONS TEST

Actual change pre-post		
Improvement	Decrease	No change
68%	19%	13%

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Key findings - Pupil level impact & outcomes

Cluster (7 primary schools & secondary school; 159 learners)

– using active learning pedagogy to support learners attitudes and skills in fractions.

PUPIL ATTITUDES TO MATHEMATICS & FRACTIONS BEFORE & FOLLOWING INTERVENTION

	Before intervention			After intervention	
		No difference			No difference
Enjoy maths more than fractions	76%	24%		50%	37%
Enjoy fractions more than maths	0%			13%	
Better at maths than fractions	88%	6%		54%	37%
Better at fractions than maths	6%			9%	
Enjoy numeracy more than I feel I am good at it	11.5%	65%		25%	33%
Better at numeracy than I enjoy it	23.5%			42%	
Enjoy fractions more than I feel I am good at it	24%	47%		17%	33%
I am better at fractions more than I enjoy learning about them	29%			50%	

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Key findings - Pupil level impact & outcomes

Cluster (7 primary schools;159 learners)

– using active learning pedagogy to support learners attitudes and skills in fractions.

COMPARISON OF PUPIL ERROR BY DECILE IN SIMD AND NUMBER OF PUPIL

SIMD decile	pre/errors (average)	post/errors (average)	CHANGE	Percentage of learners with reduced errors
1 (n=8)	19.5	13.75	-5.75	88%
2 (n=8)	9.75	10.5	+.75	63%
3 (n=30)	11.18	8.33	-2.85	80%
4 (n=15)	10.33	8.27	-2.06	87%
5 (n=25)	9.72	7.12	-2.6	80%
6 (n=7)	8	4.29	-3.71	100%
7 (n=6)	4.83	5	+0.17	67%
8 (n=18)	9.28	6.33	-2.95	89%
9 (n=32)	6.03	4.56	-1.47	81%
10 (n=10)	5.9	1.8	-4.1	80%
WHOLE SAMPLE (n=159)	9.25	6.82	-2.43	82%

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RESULTS

OUR FINDINGS INDICATE THAT:

- PARTICIPANTS USED ACTION RESEARCH TO IDENTIFY GAPS AND DESIGN INTERVENTIONS AND MEASURES IN NUMERACY
- CHILDREN MADE GAINS IN THE TARGETED AREA OF NUMERACY;
- CHILDREN AFFECTED BY POVERTY MADE GAINS IN NUMERACY;
- THE COACH CONSULT METHOD WAS AN EFFECTIVE METHOD IN PROMOTING TEACHER RESEARCH;
- CONTINUITY OF STAFF AND LEADERS WITHIN SCHOOLS, A CRITICAL MASS OF STAFF, IS VITAL FOR IMPROVEMENT TO BE IMPLEMENTED, EVIDENCED AND SUSTAINED

TEACHER RESEARCH SKILLS

- MULTIPLE SOURCES OF DATA
- MULTIPLE METHODS
- COMPARISON WITH WIDER ATTAINMENT MEASURES
- COMPARISONS WITHIN THE POVERTY RELATED ATTAINMENT GAPS
- RELIABILITY
- VALIDITY
- TRANSFERABILITY

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IMPLEMENTATION

Enhance	Hinders	Theory
Project team (of delegates) Composition and scale	Changing personnel	Implementation science Teacher efficacy
Team agreement approach	School priority/commitment	Teacher efficacy
Robust needs analysis & all gaps identified	Pressure to implement intervention(s) too quickly	Socio-cultural
Contextual intervention decisions	"Quick fix"	Systems theory
Just in time training and Consultation	Prior learning	Andragogy – adult learners
Project Management skills Planning and goal setting	Using valid and reliable tools/methods	Practitioner research

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KEY THEORY – MATHEMATICS AND NUMERACY

- ATTITUDES AND SELF-CONCEPT AS A LEARNER
- POWER OF MANIPULATIVES AND REPRESENTATIONS - *CONCRETE, PICTORIAL, ABSTRACT*
- LITERACY DEMANDS IN NUMERACY

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RECOMMENDATIONS

- PRACTITIONER RESEARCH VALID APPROACH TO ADDRESS ATTAINMENT GAPS
- PROCESS FACTORS
  - CRITICAL MASS OF CONTINUITY
  - RESEARCH DESIGN PHASE
  - IMPLEMENTATION – ONGOING PROBLEM SOLVING/COACHING/PRACTICAL TOOLS TO ASSIST SCHOOLS

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DISCUSSION POINTS

- COLLABORATIVE RESEARCH
- META-STUDIES AND THE FUTURE ROLE
- TEACHER/PRACTITIONER RESEARCH – LONG TERM IMPROVEMENT

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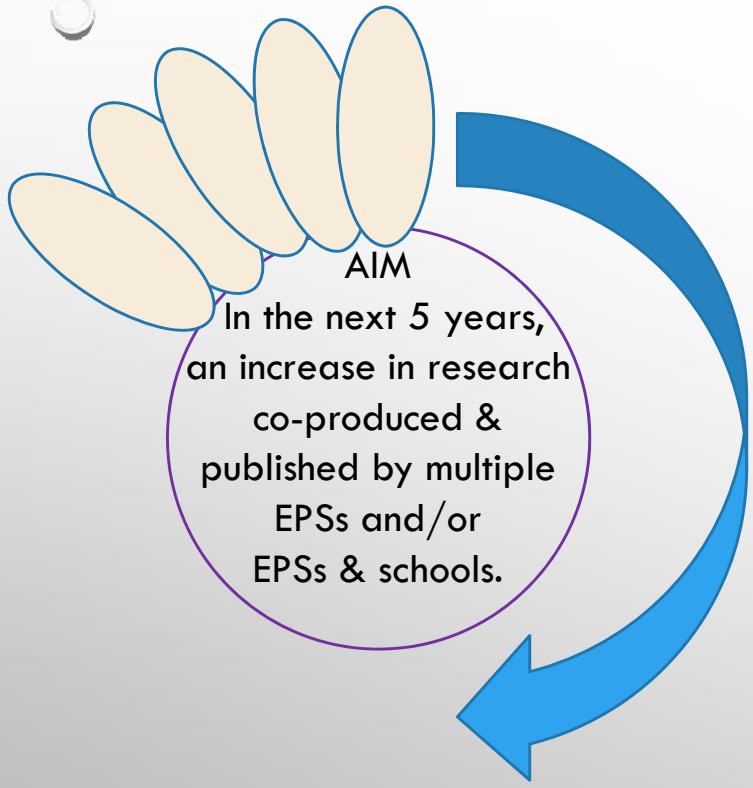

AIM

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