THE VISIBILITY AND PORTRAYAL OF GIRLS AND WOMEN IN MATHEMATICS-RELATED PICTURE BOOKS

THE DEVELOPMENT OF THE ANALYTICAL FRAMEWORK

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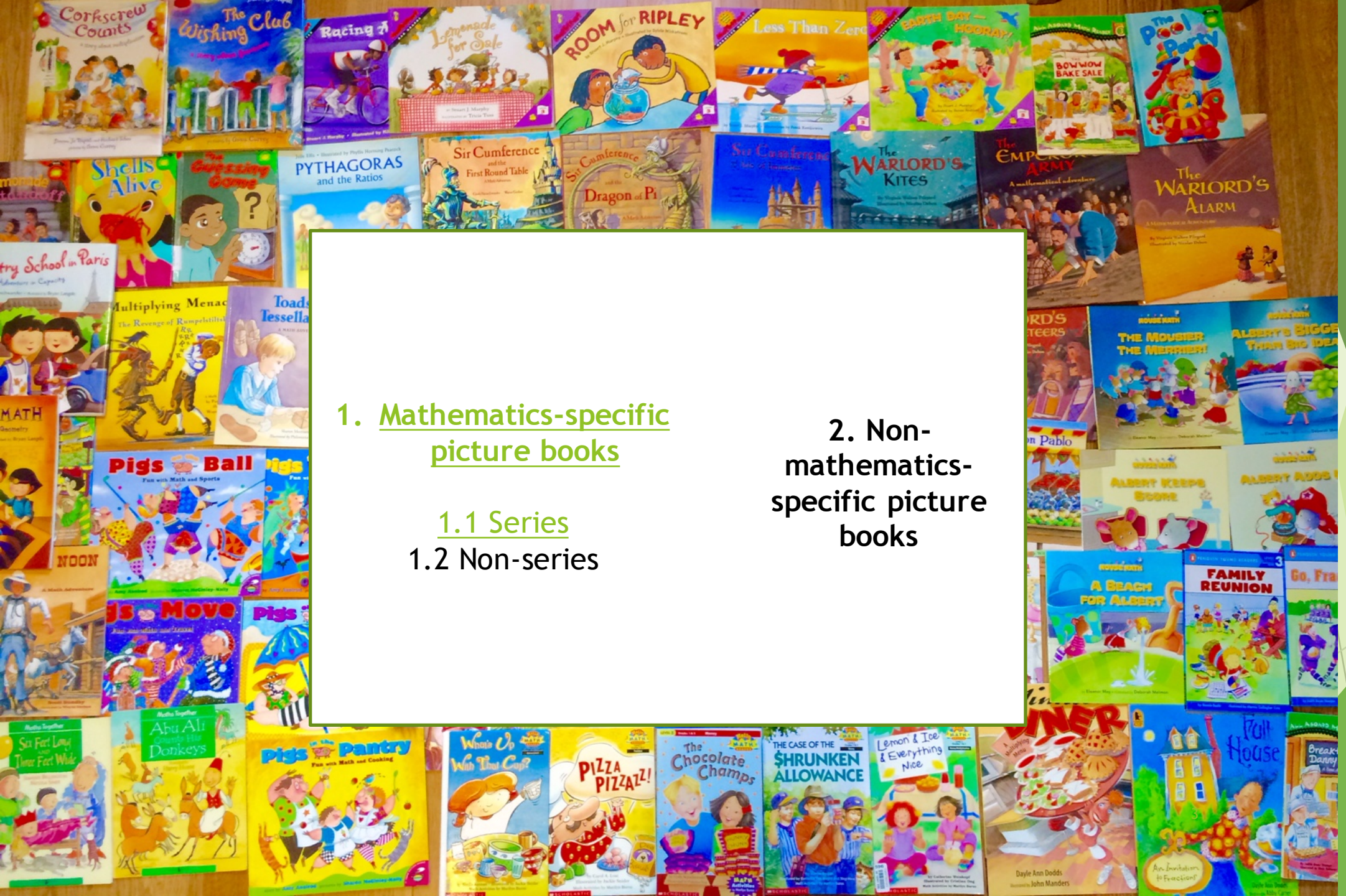
CHILDREN'S LITERATURE AND MATHEMATICS LEARNING

Within the Reading section on the English programme of study:

"**All pupils must be encouraged to read widely** across both **fiction** and non-fiction to develop their knowledge of themselves and the world in which they live, to establish an appreciation and love of reading, and **to gain knowledge across the curriculum**." (DfE, 2013, p. 14)



1. Mathematics-specific picture books

   1.1 Series

   1.2 Non-series

2. Non-mathematics-specific picture books

GENDER REPRESENTATION AND PORTRAYAL IN CHILDREN'S LITERATURE

Weitzman et al. (1972) argue that:

"Picture books are read to children when they are most impressionable, before other socialization influences (such as school, teachers and pees) become more important at later stages in the child's development." (pp. 1126-1127)

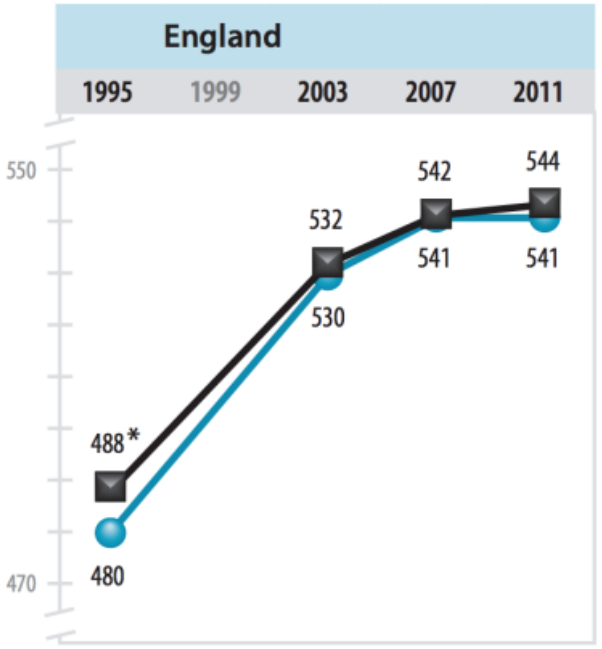
"Children invest their intellects and imaginations in picture books at a time when they are forming their self-images and future expectations." (p. 1146)

GENDER DIFFERENCES IN SELF-PERCEIVED COMPETENCE LEVEL IN AND ANXIETY TOWARDS MATHEMATICS

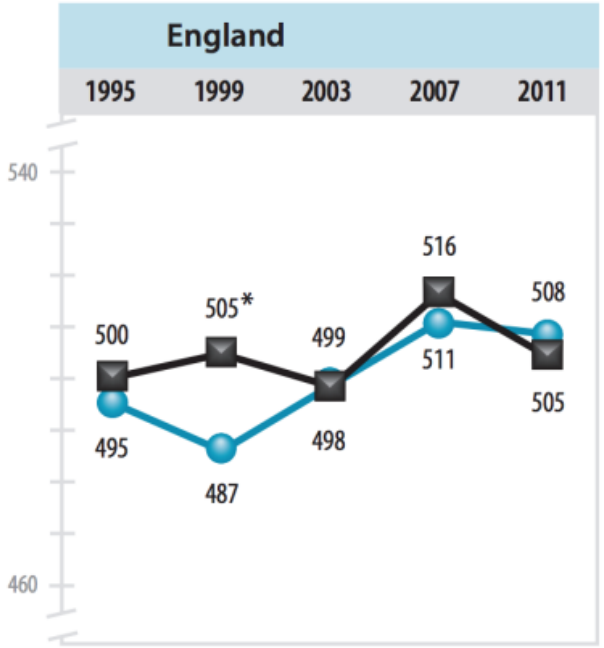
Young girls are more likely than their male counterparts to experience anxiety and have lower perceived competence level in mathematics (Devine, Fawcett, Szucs, & Dowker, 2012; Dowker, Bennett, & Smith, 2012; Frenzel, Pekrun, & Goetz, 2007)

ENGLAND'S TIMSS MATHEMATICS PERFORMANCE BY GENDER

4th Grade (Year 5)



8th Grade (Year 9)



Girls — Boys — * Achievement significantly higher than other gender

Source: http://timssandpirls.bc.edu/timss2011/downloads/T11_IR_Mathematics_FullBook.pdf

GENDER DISPARITY IN A-LEVEL MATHEMATICS / FURTHER MATHEMATICS PREFERENCE

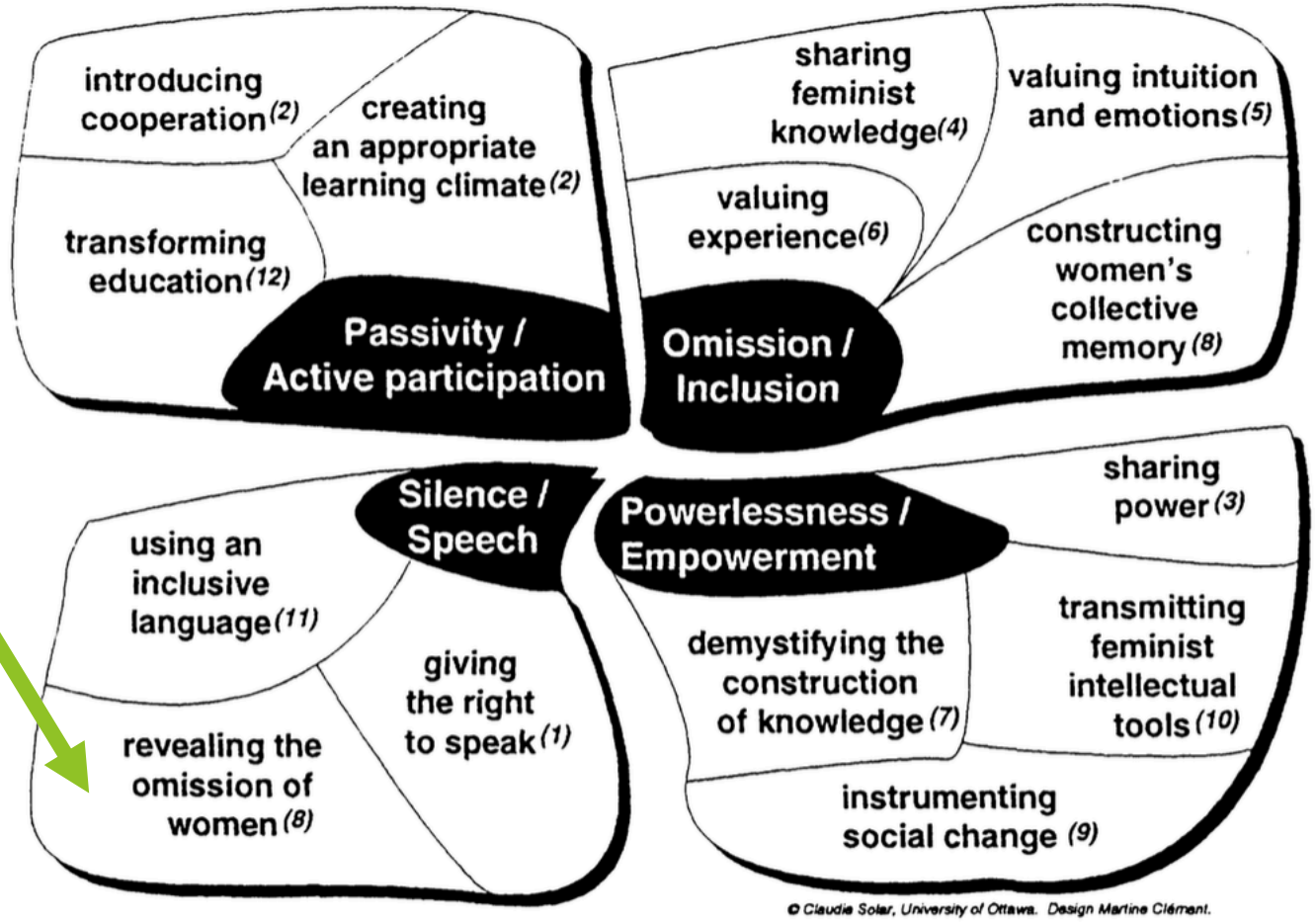
A Level in Mathematics and Further Mathematics in 2013-2014 in England

% taking A Level in Mathematics (Boys)	% taking A Level in Mathematics (Girls)	% taking A Level in Further Mathematics (Boys)	% taking A Level in Further Mathematics (Girls)
36.6	18.3	6.7	1.9

Source:
http://www.furthermaths.org.uk/docs/Girls%20in%20mathematics%20participation%20update%20Mar%202015%20v3.pdf

FEMINIST PEDAGOGY AS THEORETICAL FRAMEWORK

Solar's (1995, p. 317) Characteristics of Feminist Pedagogy



Gerbner and Gross's (1972) ***symbolic annihilation***, highlighting the absence or underrepresentation of minority groups in cultural products

"Feminist pedagogy […] seeks to break through silence and passivity and to empower subordinate groups"

(Thorne, 1984, p. 6)

GENDER VISIBILITY AND PORTRAYAL IN CHILDREN'S LITERATURE

Studies	Visibility	Portrayal
Chick et al. (2012) USA 63 primary school picture books (2006-2008)	Males are represented 1.62 times more often as central characters than females Of the books that had only one gender represented, books that had male character(s) only (N = 23) are 1.77 times more than books that had female character(s) only (N = 13).	Males were more likely to participate in sports, fight in battles or demonstrate aggressive behaviours, earning a living, etc. Female were more likely to perform domestic chores and demonstrate affection or emotion
McCabe et al. (2011) USA 5,618 children's books (1900-2000)	Males are represented 1.9 times more often in titles than their females Males are represented 1.6 times more often as central characters than females	n/a
Weitzman et al. (1972) USA 18 pre-school picture books (1967-1972)	Nearly a third of the sample featured no female characters at all There are 11 times more illustrations that feature male characters (N = 11) than there are books that feature female characters (N = 1). There are 8 times more books that feature male names in the titles (N = 11) than there are books with female names (N = 1).	Boys are assigned more exciting and adventuresome roles, engaging in more varied pursuits and demand more independence Girls are passive and immobile, and as well as often found more indoors.

RESEARCH QUESTIONS

VISIBILITY (Quantitative)

1. To what extent does the **visibility** of female characters differ from that of their male counterparts in:
    1.1) the book titles;
    1.2) the gender of characters shown on front cover;
    1.3) the amount of dialogue given to characters; *and*
    1.4) the number of characters with dialogue?

2. Does the visibility of female characters differ according to:
    2.1) publication year (Year 2000 and before vs after Year 2000);
    2.2) target audience (Key Stage 1 vs Key Stage 2); *and*
    2.3) gender of author?

PORTRAYAL (Qualitative)

3. How are central female characters portrayed in mathematics-specific picture books?

RESEARCH DESIGN

SAMPLE SIZE, SAMPLING STRATEGIES & SELECTION CRITERIA

64 picture books - purposive sampling strategy first (using the selection criteria below), then random sampling strategy

- Only English-language picture books, regardless of where and when they are published, are selected.
- Picture books must contain dialogues between characters. Wordless picture books are excluded.
- Only picture books that are mathematics-specific are selected (e.g. either picture books that are part of a 'mathematics' series or picture books with a mathematical vocabulary clearly evident in their titles)
- Mathematics-specific picture books that are essentially explanatory in nature that do not have plots or characters are excluded
- Only mathematics-specific picture books that contain contents aimed at primary school children (as judged by the National Primary Mathematics Programme of Study, DfE, 2013) are selected.
- 64 picture books that meet these selection criteria were then randomly selected from the entire population of eligible picture books (just over 200 books)

DATA ANALYSIS

VISIBILITY (Quantitative)

- Content analysis for coding
- A range of descriptive and inferential statistical analyses were performed on the data. Details to be given when findings are discussed →

PORTRAYAL (Qualitative)

- Grounded theory approach

FINDINGS

1. To what extent does the **visibility** of female characters differ from that of their male counterparts in:

    1.1) the book titles;

    1.2) the gender of characters shown on front cover;

    1.3) the amount of dialogue given to characters; *and*

    1.4) the number of characters with dialogue?

FINDINGS # 1.1 & 1.2

DIFFERENCE, IF ANY, BETWEEN THE NUMBER OF MALE AND FEMALE CHARACTERS IN BOOK TITLES AND FRONT COVERS

1.1 Book titles	1.2 Front covers
No gender identifier 38/64 (59.36)	**Male and female characters:** 35/64 (54.69%)
Male character(s) only: 23/64 (35.94%)	**Male character(s) only:** 22/64 (34.38%)
Female character(s) only: 3/64 (4.69%)	**Female character(s) only:** 7/64 (10.94%)
Male : Female ratio = 1 : 0.13	Male : Female ratio = 1 : 0.32
(M feature 7.67 times more than F)	*(M feature 3.14 times more than F)*

FINDING # 1.3
DIFFERENCE, IF ANY, BETWEEN THE NUMBER OF MALE AND FEMALE CHARACTERS WITH DIALOGUE

Average number of **male characters** with dialogue per book:

M = 3.38, SD = 2.19

Average number of **female characters** with dialogue per book:

M = 2.27, SD = 1.75

Male : Female ratio = 1 : 0.67

(M feature 1.49 times more than F)

Paired-Samples T-test: $t(63) = 3.97, p = .000$

FINDING # 1.4
DIFFERENCE, IF ANY, BETWEEN THE AMOUNT OF DIALOGUE ASSIGNED TO MALE AND FEMALE CHARACTERS

Average amount of dialogue assigned to **male characters** per book:

M = 245.70, SD = 197.48

Average amount of dialogue assigned to **female characters** per book:

M = 166.27, SD = 147.99

Male : Female ratio = 1 : 0.68

(M feature 1.48 times more than F)

Paired-Samples T-test: $t(63) = 2.84, p = .006$

FINDING # 1.4

DIFFERENCE, IF ANY, BETWEEN THE AMOUNT OF DIALOGUE ASSIGNED TO MALE AND FEMALE CHARACTERS

Categories	Number of Picture books		
1. Stories with either no female characters at all or with female characters but without dialogue	2	20	40
2. Stories with female character(s) with spoken dialogue amounted to less than 25% of the total spoken dialogue	18		
3. Stories with female character(s) with spoken dialogue amounted to more than 25%, but less than 50% of the total spoken dialogue	20	20	
4. Stories with female character(s) with spoken dialogue amounted to more than 50%, but less than 75% of the total spoken dialogue	17	17	24
5. Stories with female character(s) with spoken dialogue amounted to more than 75%, but less than 100% of the total spoken dialogue	4	7	
6. Stories with either no male characters at all or with male characters but without dialogue	3		
Total	**64**	**64**	**64**

FINDINGS

2. Does the visibility of female characters differ according to:
    2.1) publication year (Year 2000 and before vs after Year 2000);
    2.2) target audience (Key Stage 1 vs Key Stage 2); *and*
    2.3) gender of author?

'Visibility' as measured by the amount of dialogue (1.4)

FINDING # 2.1

AMOUNT OF DIALOGUE BY FEMALE CHARACTERS ACCORDING TO PUBLICATION YEAR

Average amount of dialogue assigned to female characters (per book) in picture books **published in the year 2000 and after (N=46)**:

M = 177.39, SD = 159.69

Average amount of dialogue assigned to female characters (per book) in picture books **published before the year 2000 (N=18)**:

M = 137.83, SD = 111.71

Female characters appear to be given, on average, **39.56 more words to speak** per book in the picture books published in the year 2000 and after, when compared to those published before 2000.

According to **Independent-samples t-test,**

such difference, however, is **not statistically significant** ($t(44.35) = 1.12$, $p = .269$).

FINDING # 2.2

AMOUNT OF DIALOGUE BY FEMALE CHARACTERS ACCORDING TO TARGET AUDIENCE (KEY STAGE 1 *VS* KEY STAGE 2)

Average amount of dialogue assigned to female characters (per book) in picture books **aimed at Key Stage 1 children (N = 32)**:

M = 139.03, SD = 93.55

Average amount of dialogue assigned to female characters (per book) in picture books **aimed at Key Stage 2 children (N = 32)**:

M = 193.50, SD = 185.02

Female characters appear to be given, on average, **54.47 more words to speak** per book in the picture books aimed at Key Stage 2 children, when compared to those aimed at Key Stage 1 children.

According to **Independent-samples t-test,**

such difference, however, is **not statistically significant** ($t(45.88) = -1.49$, $p = .144$)[21]

Caution:

This could simply be a consequence of KS1 books, on average, contain fewer words (narrative and dialogue) when compared to their KS2 counterparts

FINDING # 2.3

AMOUNT OF DIALOGUE BY FEMALE CHARACTERS ACCORDING TO GENDER OF AUTHORS

Average amount of dialogue assigned to female characters (per book) in picture books **written by female authors (N = 58):**

M = 174.45, SD = 152.03

Average amount of dialogue assigned to female characters (per book) in picture books **written by male authors (N = 6):**

M = 87.17, SD = 64.94

Female characters appear to be given, on average, **87.28 more words to speak** per book in the picture books authored by female authors, when compared to those authored by male authors.

According to **Independent-samples t-test,**

such difference, however, is **not statistically significant** ($t(62) = -1.39$, $p = .171$).

Caution:

The very small sample size of picture books authored by male authors (N = 6) could skew the finding

CONCLUSIONS

1.1 Gender differences as found in …	Findings
1.1 Book titles	Male : Female ratio = 1 : 0.13 *(M feature 7.67 times more than F)*
1.2 Front covers	Male : Female ratio = 1 : 0.32 *(M feature 3.14 times more than F)*
1.3 Number of speaking characters	Male : Female ratio = 1 : 0.67 *(M feature 1.49 times more than F)*
1.4 Dialogue amount	Male : Female ratio = 1 : 0.68 *(M feature 1.48 times more than F)*

1.1 Gender differences according to …	Findings
1.1 Publication year	*Not statistically significantly different*
1.2 Target audience	*Not statistically significantly different*
1.3 Gender of author	*Not statistically significantly different*

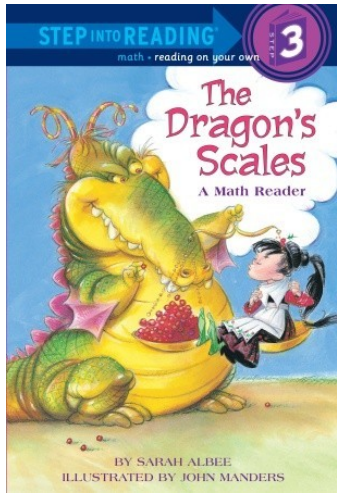
PORTRAYAL OF FEMALE CHARACTERS

(QUALITATIVE)

ISSUES

- Existing coding frameworks on how girls and women are portrayed are not as relevant to my study e.g. a housewife can still apply her mathematical knowledge to solve problems
- Should I just focus on analysing roles of central female characters or secondary (and only) female characters too?

THE CASES OF …



Holly

Erdine

Q&A

REFERENCES

Chick, K. A., Slekar, T. D., & Charles, E. P. (2010). A gender analysis of NCSS Notable Picture Book Winners: 2006-2008. *Social Studies Research and Practice*, 5(3), 21-35.

Department for Education (2013). *The National Curriculum in England*. London: Department for Education.

Devine, A., Fawcett, K., Szűcs, D., & Dowker, A. (2012). Gender differences in mathematics anxiety and the relation to mathematics performance while controlling for test anxiety. *Behavioral and Brain Functions*, 8(33), doi: 10.1186/1744-9081-8-33

Dowker, A., Bennett, K., & Smith, L. (2012). Attitudes to mathematics in primary school children. *Child Development Research*, 1-9. doi:10.1155/2012/124939

Frenzel, A. C., Pekrun, R., & Goetz, T. (2007). Girls and mathematics – A "hopeless" issue? A control-value approach to gender differences in emotions towards mathematics. European *Journal of Psychology of Education*, 22(4), 497-514.

REFERENCES

Gerbner, G., & Gross, L. (1976). Living with television: The violence profile. *Journal of Communication*, 26, 172-199.

McCabe, J., Fairchild, E., Grauerholz, L., Pescosolido, B. A., & Tope, D. (2011). Gender in twentieth century children's books: Patterns of disparity in titles and central characters. *Gender & Society, 25*(2), 197-226.

Solar, C. (1995). An inclusive pedagogy in mathematics education. *Educational Studies in Mathematics*, 28(3), 311-333.

Thorne, B. (1984). Rethinking the way we teach. In K. Loring (Ed.), *Feminist Pedagogy and the Learning Climate*. Proceedings of the 9th Annual GLCA Women's Studies Association, Ann Arbor, Michigan.

Weitzman, L., Eifler, D., Hokada, E., & Ross, C. (1972). Sex-role socialization in picture books for presechool children. *American Journal of Sociology*, 77, 1125-1150.