Pre-service teachers' beliefs about the teaching and learning of mathematics in preschool

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Objective of this presentation

Present the results of a questionnaire submitted to pre-service teachers ...

... regarding their beliefs about the teaching and the learning of mathematics in preschool

The questionnaire consists of two parts (math and parental involvement) but only the results of the math part will be presented.

Overview of the presentation

1. Context of the questionnaire
2. Teachers' beliefs about mathematics in preschool
3. Method

   Construction of the questionnaire and chosen dimensions
4. Some main results

   Evolution of students' beliefs from the 1st to the 4th year of the BScE.
5. Conclusions and perspectives

1. Context of the questionnaire

Failure in mathematics

- Traditional mathematics are often a source of demotivation. "They are synonymous of fear, constraint and abstraction" (Baruk, 1985).
- The probability of leaving school is clearly related to failures in mathematics according to a study carried out in Québec with 800 7th grade students (Fortin et al. in Deslandes et Lafortune, 2001 ; Lessard et al., 2007)
- In Luxembourg,
  - important multiliculturalism and multilingualism : nearly 50% of school population is foreign;
  - the language learning is highly considered;
  - mathematics produce more failures than language and other subjects matter, both in primary and secondary school (MEN, 2013).

Failure in mathematics

- **The 2012 PISA results** show no progress in math since 2006 with a score below the OECD mean (494), while we observe some progress in language and in sciences :

	Math	Langue	Sciences
2012	**490**	**488**	**491**
2009	492	472	484
2006	490	479	486

Failure in mathematics
The importance of early number competencies

- The importance of early mathematics education has drawn increasing attention in recent years (Chen, McGray, Adams & Leow, 2014; Jalbert & Pagani, 2007; Jordan, Kaplan, Ramineni & Locuniak, 2009; Krajewski & Schneider, 2008; Platas, 2014).
- Many studies consider counting as the most fundamental tool to enhance arithmetical abilities during the first grades of primary school.
- Most research shows that initial number knowledge forms the basis for understanding several major principles of the number system (Krajewsjki and Schneider, 2008).
- Moreover, early number competencies are considered as strong predictors of mathematics outcomes at the end of first grade and even later on.

Failure in mathematics
The importance of early number competencies

- However, these numerical competencies do not spontaneously develop, even if there is an innate perceptual process, the so-called "number sense" (Bideaud, Lehalle & Villette, 2004; Boonen, Kolkman & Kroesbergen, 2010; Dehaene, 2001).
- These competencies have to be learned and, in this context, the role of preschool education and the part played by families are of crucial importance.
- Mathematics learning must be planned and opportunities for learning must be created .
- But what do the preschool teachers think about mathematics ?

2. Teachers' beliefs about mathematics in preschool

Place of mathematics in preschool

- Currently, only few studies have examined preschool teachers' beliefs about early childhood mathematics curriculum and instruction (Lee & Ginsburg, 2007; Platas, 2014).

- However, these beliefs need to be further investigated in order to achieve a high quality mathematics education in the preschool classrooms (Herron, 2010).

Place of mathematics in preschool

Studies have shown that preschool teachers experience fear and/or hatred of mathematics.

(Copley, 2004; Hachey, 2013; Lee, 2006; Lee & Ginsburg, 2009)

- They lack confidence in their ability to teach mathematics 'correctly,' even in preschool.
- They do not place high value on teaching mathematics.
- They do not devote much time to this subject but instead they give the priority to social, emotional and physical development over academic subjects.
- In academic subjects, language and literacy are considered as more important than mathematics.

Place of mathematics in preschool

The statement about the priority given to language over mathematics is supported by empirical data:

	Time math	Time language	Time math + language
Early et al.study (2005)	8%	21%	29%

- A little less than **1/3 of the time** (29%) is spent on **academic subjects** (mathematics and language).
- Of all the academic time, around **1/3 of the time** (8%) is devoted to **mathematics** while around **2/3** are devoted to **language** (21%).

Preschool teachers' beliefs

Qualitative research : Lee & Ginsburg's works (2009)

Nine misconceptions (Lee & Ginsburg, 2009)

1. Young children are not ready for mathematics education.
2. Mathematics is for bright kids with mathematics genes.
3. Simple numbers and shapes are enough.
4. Language and literacy are more important than mathematics.
5. Teachers should provide an enriched physical environment, step back, and let the children play.
6. Mathematics should not be taught as stand-alone subject matter.
7. Assessment in mathematics is irrelevant when it comes to young children.
8. Children learn mathematics only by interacting with concrete objects.
9. Computers are inappropriate for teaching and learning mathematics.

Preschool teachers' beliefs

Quantitative studies : Platas' works (2014)

Four dimensions identified as being important in determining whether mathematics instruction is implemented in early childhood classrooms (Platas, 2014) :

1. **The primary goals of preschool instruction :** mathematics, a primary goal?
2. **Age-appropriateness of mathematics instruction**
3. **Classroom locus of generation of mathematical knowledge** (teacher versus child)
4. **Confidence in mathematics instruction**

Good validity for the 4 dimensions (Cronbach Alpha between .84 et .94)

3. Method

Method

- **Sample :** 258 pre-service students (2013-2014)
  of the Bachelor in Sciences of Education (BScE)

1st year	2nd year	3rd year	4th year	not mentioned year	Total
72	23	88	75	5	**258/263**

- **Questionnaire consisting of two parts:**
  1. **Teaching and learning of mathematics in preschool**
  2. The role of parental involvement
- **Likert** scale in 6 positions:

Strongly disagree	Desagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree

Method

Measured dimensions in mathematics

1. Platas dimensions (2014) : adaptation

	Nb items	α cronbach
A.1 Primary goals of preschool	6	.73
A.2 Classroom locus of the generation of mathematical knowledge	12	.73
A.3 Age appropriatness of mathematics instruction	**7**	.83
A.4 Teacher confidence in mathematics instruction	6	.84

2. **The distribution of time between the different preschool areas**
3. Mathematical contents priviledged
4. Classroom practices for teaching number and operations in preschool (formal, material based, functional).
5. Nine misconceptions (Lee & Ginsburg, 2009)

Method

Research questions investigated in this presentation

QR1/ How do pre-service teachers beliefs evolve from the 1st to the 4th year of their studies regarding mathematics, in particularly :

the three first Platas' dimensions

the distribution of time between the different preschool area

QR2/ Do the pre-service teachers beliefs differ by subjects matter: mathematics, language, psychomotricity and arts?

4. Results

The primary goals of preschool

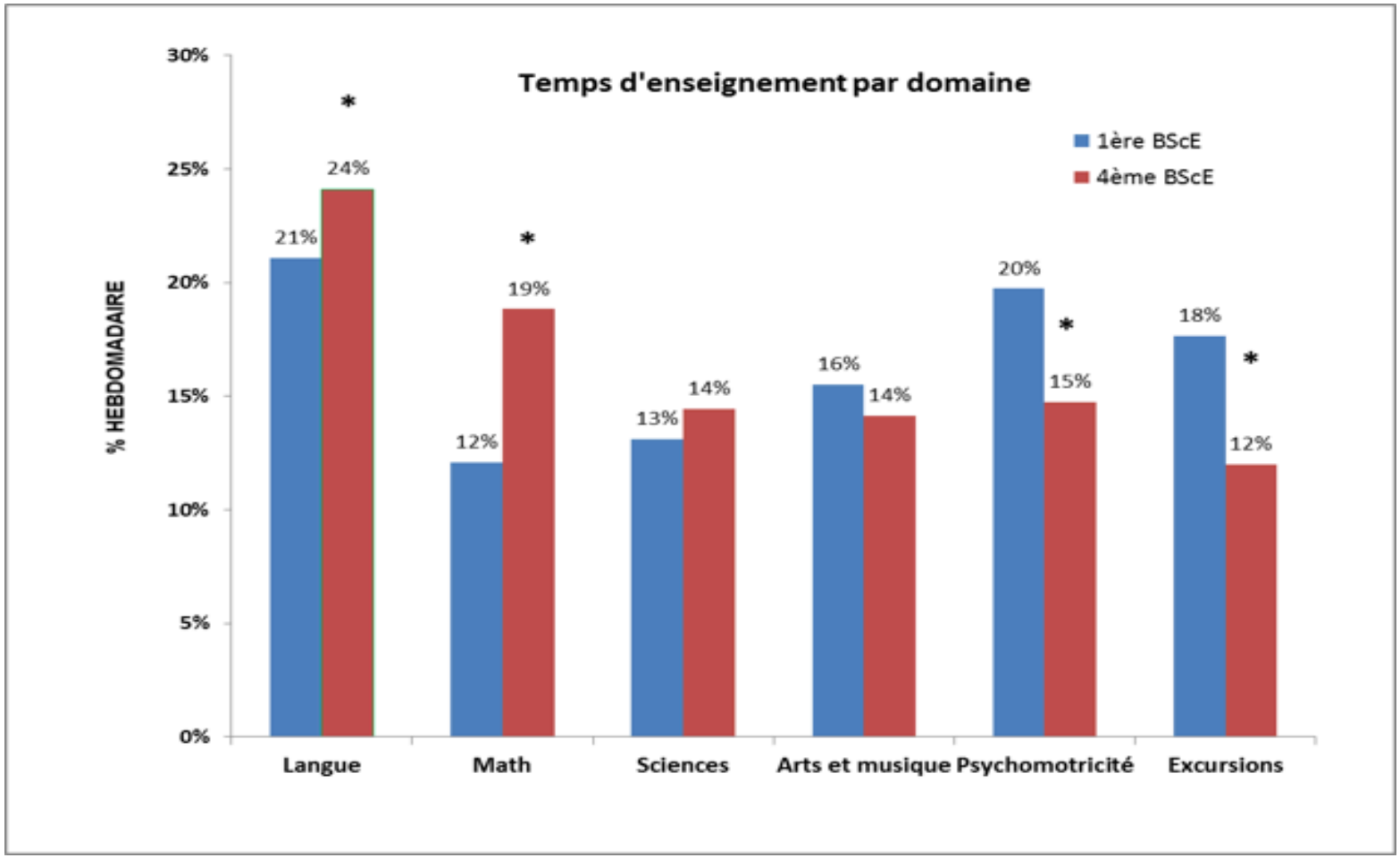
On the whole dimension

	1ère year Mean	4e year Mean	Difference	% Difference	
Math	**3.09**	**4.17**	**0.28**	**1.08**	**p < 0.001**
Language	3.93	4.34	0.01	0.41	p < 0.001
Arts	4.11	4.32	0.21	0.21	p < 0.03
Psychomotric.	4.26	4.39	0,13	0.13	NS

0	1	2	3	4	5
strongly disagree	desagree	somewhat disagree	somewhat agree	agree	strongly agree

More fourth-year than first-year students think that mathematics are important in preschool.

The distribution of time between the different areas



The classroom locus of the generation of mathematical knowledge

1st year Mean	4th year Mean	Différence	
2.44	2.02	- 0,42	$p < 0.001$

- In 1st year, students' average position between the two sides .
- In 4th year, stronger agreement towards the teacher side. The 4th year students attribute a more important role to the teachers

The classroom locus of the generation of mathematical knowledge

% somewhat agree + agree + strongly agree

Locus "child" : example of item	1st year	4th year	
Teachers should provide a rich environment ... and let the children play and discover for themselves	85%	48%	$p < 0.001$

Locus "teacher" : example of item	1st year	4th year	
It is important that the teacher plans and organizes the targeted activities on mathematics itself	53 %	83 %	$p < 0.002$

Age appropriatness

On the whole dimension

	1st year Mean	4th year Mean	Difference	
Math	3.04	4.33	1.29	$p < 0.001$
Language	3.79	4.40	0.61	$p < 0.001$
Arts	4.34	4.51	0.17	NS
Psychomot	4.38	4.54	0.16	NS

- In 1st year, the children are considered as mature especially for the arts and the psychomotricity.
- In 4th year, the positions adopted for languages and math change and are similar to those of arts and psychomotricity

0	1	2	3	4	5
strongly disagree	desagree	somewhat disagree	somewhat agree	agree	strongly agree

5. Conclusions and perspectives

Conclusions

1. 1st year students ...
   - ✓ consider mathematics as the less important subject matter regarding language, art and psycomotricity;
   - ✓ seem to share the beliefs identified in the research literature for in-service teachers
2. Clear change in the beliefs of pre-service teachers at the end of their studies:
   - ✓ academic contents (mathematics and language) become as important as psychomotricity and arts, and ...
   - ✓ ... the change in mathematics is the most striking regarding language;
   - ✓ mathematics become an important objective of preschool ...
   - ✓ ...to which they must devote teaching time

Conclusions

3. 4th year students give an important place:
   - to academic subjects like math, which are now considered almost like language.
   - to the role of the teacher who must organize and conduct activities targeting mathematics itself
4. These results are likely to be related to changes in the consideration of the young child who is now considered by the 4th year students as mature enough to do math.
5. Different hypotheses : experience in classrooms (internships), curricular context but also the courses related to preschool and the development of math in preschool. (cf Platas, 2014)

Perspectives

- The awareness of future teachers about the importance of math at preschool and their role as teacher could contribute to reducing school failure in mathematics.
- To this end, joint action on pre- and in-service training of teachers would be necessary.
- This study was a preliminary study for a project, the MathPlay project, whose objective is to develop early number competencies in school and in family contexts:
  - ✓ Design and implement a play-based mathematics approach in preschool through a professional development programme (PD programme).
  - ✓ Evaluate the short- and medium-term impact of games, organised both in school (play-based approach) and at home, on early number competencies.

Thank you for your attention

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L'âge approprié : Est-ce que les enfants sont suffisamment matures sur le plan développemental pour apprendre les mathématiques au préscolaire?

HISTORIQUEMENT (Ginsburg, 2000; Hachey, 2013b),

1. Au cours de la première moitié du 20ème siècle,

   Les jeunes enfants sont considérés comme comme inaptes en mathématiques et l'enseignement des mathématiques au préscolaire est considérés comme inutile (Hachey, 2013)

2. Dans les années 60s,

   Le développement des travaux en psychologie cognitive se sont centrés sur les capacités des jeunes enfants en mathématiques (plutôt que sur leur manque).

   Malgré tout, l'enfant étant jugé immature pour comprendre les concepts abstraits et la pensée logique requise en mathématiques et il semble que l'enseignement intentionel des mathématiques soit toujours laissé à l'école primaire

L'origine de la production du savoir mathématique chez les élèves

Certains pensent que la construction de leur savoir mathématique doit être dévolue à l'enfant tandis que d'autres pensent que c'est la responsabilité de l'enseignant

Selon Lee (2006) de même que Lee & Ginsburg (2007) :

- Il faut laisser le choix des activités aux enfants
- Les enseignants doivent se limiter offrir un environnement riche, prendre du recul et laisser les enfants jouer et découvrir par eux-mêmes.
- Les mathématiques ne doivent pas être enseignées en tant que telles mais seulement si les enfants montrent un intérêt.

Les croyances des enseignants

Etudes quantitatives : Travaux de Platas

Platas (2014) a testé et validé ces quatre dimensions auprès de 340 (futurs) enseignants :

	Statut	Formation	N
cohorte 1	étudiant en formation enseignant	pas de cours en éducation préscolaire	135
cohorte 2	enseignant (au moins 2 ans d'expérience au préscolaire)	suivant un programme de formation en éducation préscolaire	147
cohorte 3	enseignant (au moins 2 ans d'expérience au préscolaire)	suivant master avec des cours en éducation **mathématique préscolaire**	64

Math Play and European recommandations

The MathPlay project is in line of the European recommantations regarding school dropout.

In June 2011, the Education Council adopted a recommendation on policies to reduce ESL (European Commission Council, 2011). Comprehensive strategies to reduce ESL have to address the entire educational spectrum and have to include prevention, intervention and compensation measures.

Prevention and intervention with respect to the following three aspects of the recommended measures form an integral part of MathPlay:

- early childhood education,
- teachers' support,
- parental involvement.

The nine misconceptions (Lee & Ginsburg, 2009)

1st year Mean	4th year Mean	Difference		α cronbach
4.17	2.13	- 2,57	p < 0,001	.77

In 1st year, with a mean of 4.17, students globally agree with the misconceptions of L&G while the 4th year students do not share the misconceptions. With a mean of 2.13, their average position is situated at "somewhat disagree" on the Likert scale.

0	1	2	3	4	5
strongly disagree	desagree	somewhat disagree	somewhat agree	agree	strongly agree