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A COMPARISON OF THE EARLY CHILDHOOD CURRICULA IN HONG KONG AND SINGAPORE – FROM THE PERSPECTIVE OF MATHEMATICS EDUCATION

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Abstract

Primary and secondary students from Hong Kong and Singapore outperformed students of many countries in mathematics in international studies. Whereas early childhood education is the foundation of elementary education, this paper aims to compare the early childhood curriculum documents of the two cities from the perspective of mathematics education and investigate the similarities and differences, if any, in their curricular intention of mathematics learning and teaching. The curricula are compared from three aspects: (1) the organization of curriculum framework; (2) the orientation of the mathematics-related content; and (3) the focuses of the mathematics-related content. It is found that both cities consider mathematics as an important and distinct learning domain in early childhood education. The analysis result shows that the two cities organize mathematics domain differently in terms of the levels of specification and the areas of emphases. The two curricula have their own characteristics as the two cities differ in cultural context and curriculum is context-specific. In light of the identified differences and

similarities, the paper suggests Hong Kong to formulate learning outcomes with closer academic links and explicit expectation with respect to children's cognitive development in mathematics. It is also suggested Singapore to elaborate the teach Principles and the PRAISE Dispositions with mathematics-related examples.

Keywords

Early Childhood Education, Mathematics Education, Curriculum Comparison

1. Background

In Hong Kong, a committee was set up in April 2013 to investigate issues related to the potential provision of free kindergarten education (Chief Executive, 2013). In the report submitted by the Committee in May 2015, it is stated that, under the vision of "Children First: Right Start for All", the objective of kindergarten education is to "lay the foundation of lifelong learning by fostering in children an inquisitive mind, an interest in learning and exploration, a balanced development, a healthy self-concept, the ability and confidence to adapt to the ever-changing world and getting them ready for school"(Committee on Free Kindergarten Education, 2015, p. ii). Sub-committee on teacher professionalism is established to study issues related to kindergarten curriculum. Whereas the importance of early childhood education (ECE) has already been widely recognized worldwide, concerns on early childhood curriculum is increasing recently in Hong Kong.

2. Literature Review

In international studies like TIMSS and PISA, performance of primary and secondary students from Hong Kong and Singapore outranked many countries in mathematics. However, Singapore ranked much lower than Hong Kong both in overall score as well asin terms of quality in the Starting Well Index - an index benchmarking preschool provision across 45 countries(Economist Intelligence Unit, 2012). In the index, a well-defined preschool curriculum is one of the main elements in determining the index score of the "quality" indicator.

Conceptions and functions of curriculum are changing (Tanner & Tanner, 1975). Research found that philosophies on curricula vary among countries (Economist Intelligence Unit, 2012). Some countries adopt "outcomes"-based approach that learning goals are specified.

Some countries are "input"-based that focus on what is expected from preschool teachers (Economist Intelligence Unit, 2012, p. 27). Over the decade, curricular intents are expressed in various forms, such as objectives, outcomes and standards (Marsh, 2009). No matter in what forms or of which approach, curriculum document in some extent is a kind of authority (Campbell, 2006) that shows the direction of the planned curriculum and affect the enacted curriculum and experienced curriculum.

Numeracy is one of the focuses in the early childhood learning frameworks in many countries (OECD, 2012a). Research shows that academic-oriented approach to curriculum is more likely to improve children's numeracy and specific knowledge (OECD, 2012b). Despite the fact that ECE curriculum in Hong Kong and Singapore are basically comprehensive in nature instead of academic-oriented, defining goals and content itself is already a challenge in designing quality ECE curriculum (OECD, 2012b). Early math skills are the significant and the strongest predictor of children's later achievement (Duncan et al.2007). Analyzing curricular content helps to reveal, if any, potential risks of comprehensive curriculum and risks of losing focus on important goals (OECD, 2012b), such as goals in mathematics learning.

It is worth noting that the analysis on curriculum guidelines for Starting Well Index was conducted in 2011 and Singapore released a new curriculum framework for kindergartens in 2012 (Ministry of Education, 2012). Lao (2014)pointed out that the current ECE curriculum documents in Hong Kong have insufficient coverage in mathematics and some important mathematical topics are omitted. Developmental characteristics of children are vaguely stated and with limited differentiation. In this critical period that Hong Kong EC Ecurriculumin is under review, this paper aims to compare the early childhood curricula of the two cities from the perspective of mathematics education by exploring in what ways the two curricula differ or similar in their curricular intention of mathematics teaching and learning.

3. Research Method

Though conceptions or orientations of curriculum differ – for instance, society-oriented, knowledge-centered, student-centered or eclectic by Longstreet and Shane (1993), learner, teacher, subject matter and milieu is the four 'commonplaces' of curriculum (Schwab, 1969). Content, purpose, organization are the three fundamental concepts of curriculum (Walker, 2003).

Through curriculum documents, curriculum makers convey curricular intentions on learning process, teaching process and subject matters to address the expectation and needs of society on education. Hence, this paper examines the curricula of two cities from three aspects, (1) organization of curriculum framework – in terms of the goals and objectives, content organization and principles of teaching in relation to mathematics; (2) orientation of mathematics-related content – in terms of the theme of sentences; (3) focuses of mathematics-related content – by topic, by level of learning and by usage of words.

For aspect (1), the official early childhood curricula of the two cities, i.e. Hong Kong Curriculum (Curriculum Development Council, 2006) and Singapore Curriculum (Ministry of Education, 2012) are used for analysis. For aspect (2) and (3), Section 2.5.3 (Early Mathematics Learning Area) (HK-MLA) and the intellectual column of the developmental characteristics for age 3-6 in Appendix 2 of Hong Kong Curriculum (HK-App) are extracted as data sources for Hong Kong. The Numeracy Learning Area of Singapore Curriculum is extracted as the data source for Singapore.

4. Results and Discussion

4.1 Organization of Curriculum Framework

In the curriculum documents of both cities, purposes of education are presented in four levels (Table 1) taking the overall purposes of formal education as the highest level but they differ by the nature of levels and by the relationship between levels. For Hong Kong, the goals of pre-primary stage are directly under the overall aims of education while the outcomes of pre-school stage are subsumed under the Key Stage Outcomes for Singapore. In return, for Hong Kong, there exists a layer of objectives clustered in four curriculum domains, namely, Physical Development, Cognitive and Language Development, Affective and Social Development and Aesthetic Development.

Table 1: *Levels of Objectives and Goals*

Hong Kong	Singapore
1. Overall Aims of Education	**1. Desired Outcomes of Education**
2. Curriculum Goals of the Pre-primary Stage	**2. Key Stage Outcomes of Education**
3. Developmental Objectives for 4 Curriculum Domains	**3. Key Stage Outcomes of Pre-school Education**
4. Learning objectives for each learning area	**4. Learning goals for each learning area**

Both cities introduce the concept of learning area as a component of the curriculum. The classification of learning areas is similar (Table 2) and early mathematics is one of the six learning areas (though in different names). For both cities, goals/objectives are specifically formulated for the mathematics-related learning area.

Table 2: *Content Organization – Classification of Learning Areas*

Hong Kong	Singapore
• **Early Mathematics**	• **Numeracy**
• **Physical Fitness and Health**	• **Motor Skills Development**
• **Language**	• **Language and Literacy**
• **Science and Technology**	• **Discovery of the World**
• **Self and Society**	• **Social and Emotional Development**
• **Arts**	• **Aesthetics and Creative Expression**

Not only different in names, contents of the mathematics-related learning area in the two curricula are different too. In Singapore Curriculum, a list of key knowledge, skills or dispositions supplemented with examples is identified under each learning goal. In Hong Kong Curriculum, instead of in the form of key knowledge, developmental characteristics of children in different ages are listed in the appendix.

On the contrary, Hong Kong elaborated the principles of teaching in the Early Mathematics Learning Area while six overarching principles of teaching are identified as common across learning areas in Singapore Curriculum.

Both cities stress the importance of developing skills, values and attitudes through the learning of knowledge in various learning areas. In Singapore Curriculum, six learning

dispositions are identified in the main body of text. For Hong Kong, numeracy skills are illustrated with examples and a set of desirable values and attitudes is proposed in the appendices rather than in the main body of the documents.

4.2 Orientation of Mathematics-related Content

For Hong Kong Curriculum, mathematics-related content mainly comes from two parts: (1) Section 2.5.3 (i.e. the Section of Early Mathematics Learning Area) (HK-MLA), and (2) developmental characteristics for age 3-6 under the intellectual column of the table in Appendix 2 of Hong Kong Curriculum (HK-App). For Singapore Curriculum, mathematics- related content mainly comes from the Numeracy Learning Area. By counting repeated sentences/phrases once only, the two curricula elaborate mathematics-related content in different lengths (Table 3).

Table 3: *Length of the Corresponding Sections of Mathematics-related Learning Area*

	Total number of words	**Total number of sentences**
HK-MLA	**384**	**21**
HK-App	**599**	**32**
Hong Kong	**983**	**53**
Singapore	**1498**	**39**

Each sentence with mathematics-related content is coded according to its main theme – the question that the sentence is addressing. The themes are classified in four categories:

- Learning process – what make it evident that children learnt mathematics in ECE?
- Teaching process - How teachers organize mathematics learning experiences in ECE?
- Input - In what ways mathematics in ECE relates to learners?
- Output - What mathematics is expected in ECE?

Table 4: *Orientation of Mathematics-related Content in Hong Kong Curriculum*

	Learning	**Teaching**	**Input**	**Output**
HK-MLA	**0**	**11**	**6**	**4**
HK-App	**32**	**0**	**0**	**0**

Table 5: *Comparison of Orientations of Mathematics-related Content*

	Learning	**Teaching**	**Input**	**Output**

Hong Kong	**60.38%**	**20.75%**	**11.32%**	**7.55%**

In Hong Kong Curriculum, the main body of text (HK-MLA) and the appendix (HK- App) take up distinct roles in presenting curricular intentions (Table 4).The former focuses more on teaching while the latter one is solely on learning. Taking the main body of text and the appendix as a whole, Hong Kong Curriculum emphasize most on how children learn and least on addressing the expectation on children's learning. For Singapore, it is relatively balance on learning process and expectation (Table 5).

4.3 Focuses of Mathematics-related Content

Early mathematics usually involves concepts in number (e.g. counting, recite numbers), relationship/pattern (e.g. ordering, making patterns) or shape and space (e.g. recognize circles, in front of/behind). By coding the mathematics topics mentioned in the data sources, the weighing patterns on topics of the two cities are similar – slightly more on relationship/patterns and least on shape and space (Table 6).

Table 6: *Classification by topic*

	Number	**Relationship/pattern**	**Shape and space**
Hong Kong	**31.43%**	**48.57%**	**20.00%**
Singapore	**35.29%**	**38.24%**	**26.47%**

The data sources are also coded against three levels of learning. Using the Bloom's Taxonomy (1956) as reference, level 1 is set as the comprehension level, e.g. to identify a numeral, to recognize a rectangle and to name it. Level 2 is the application level, e.g. to show the exact quantity of a given number of ten or below, to reproduce a given pattern, to compare two objects and use appropriate vocabulary to describe. Level 3 is the extension level, e.g. to create simple patterns. Two cities follow extremely similar weighing pattern across the three levels of learning, descending from the lowest level 1 to the highest level 3 (Table 7).

Table 7: *Classification by level of learning*

	level 1	**level 2**	**level 3**

Hong Kong	**57.41%**	**35.19%**	**7.41%**
Singapore	**56.25%**	**35.94%**	**7.81%**

In the main body of text (HK-MLA) and the appendix (HK-App) of Hong Kong Curriculum, 7 out of the top 10 frequent words are the same but the words "interest", "experiences" and "teachers" appear only in the main text. From the lists of top 10 most frequent words of the two cities (Table 8), four words are common – children, learning, objects, and things. Top 10 frequent words in Hong Kong Curriculum are relatively abstract and broad in meaning (e.g. mathematical, concepts, develop) while academic links with mathematics are more explicitly in Singapore Curriculum (e.g. number, shapes, quantity, patterns, count).

Table 8: *Top 10 Most Frequent Words*

Hong Kong	**Singapore**
1. able	**1. use**
2. children	**2. things**
3. mathematical	**3. number**
4. objects	**4. children**
5. one	**5. learning**
6. concepts	**6. objects**
7. activities	**7. shapes**
8. learning	**8. quantity**
9. things	**9. patterns**
10. develop	**10. count**

5. Conclusion

To conclude, both cities take early childhood education as an integral part of education. Mathematics is considered as essential learning experiences for children in early childhood education. The two cities recognize the distinct nature of mathematics learning domain and the needs of domain-specific objectives but they differ in the levels of specification as well as the areas for specification. Both cities expect affective development in connection with cognitive

development of children through mathematics learning in early childhood education. However, the two cities recognize the uniqueness of early mathematics but focusing on different curricular elements. In Hong Kong Curriculum, learning and teaching principles for mathematics are specially elaborated whereas, in Singapore, key content and children's development are identified and elaborated instead. Both cities show their concerns in early mathematics with different stresses. Hong Kong concerns more on children's learning process instead of indicating their expectation in the curriculum. For Singapore, stating their expectation is in general as important as expressing their concerns on children's learning process. Topic coverage and levels of learning are similar for both cities but usage of words is more academic-oriented in Singapore curriculum.

Curriculum is context-specific as education has to address the needs of teachers and society. Hence, curricula of the two cities have their own characteristics. Curriculum documents serve to indicate the curricular intention to stakeholders, such as teachers. For Hong Kong, though there might have a potential hazard of misinterpretation and backwash effect of performance indicators of children, clear learning outcomes are still desirable for early childhood teachers (Committee on Free Kindergarten Education, 2015). Under the background that mathematics knowledge of early childhood teachers in Hong Kong varies greatly (Lao, 2014), it is suggested that learning outcomes should be formulated in a way that explicit expectation on children's competence in early mathematics should be clearly stated with closer academic links in light of children's cognitive development in mathematics. It helps to raise teachers' awareness of children's competences in early mathematics.

For Singapore, six overarching guiding principles for teaching and learning (in acronym form –it each) are introduced. Teachers are expected to engage children in learning through purposeful play and facilitate authentic learning through quality interaction with children so that children become the constructors of knowledge. However, what kind of purposeful play and authentic learning experience could effectively facilitate children to construct their mathematical knowledge? Further elaboration on the principles with mathematics-related examples would be beneficial.

For both cities, there is a need to elaborate further on how affective development can be achieved through mathematics learning in early childhood education. In Singapore Curriculum,

similar to the teach Principle, six dispositions (in acronym form - PRAISE) are identified and teachers are expected to nurture them via various learning areas. However, under each learning goal of the Numeracy Learning Area, focuses are mainly on key knowledge and skills instead of dispositions. For Hong Kong, the proposed set of values and attitudes comprised of more than 65 entries. By selecting some of the entries for illustration with examples in early mathematics, it would provide teachers with a clearer direction and good start to incorporate them in curriculum.

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