**THE EDUCATION UNIVERSITY OF HONG KONG**

**Course Outline**

**Part I**

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**Programme Title :** Master of Arts in Mathematics and Pedagogy

Master of Education

**Programme QF Level** **:** 6

**Course Title :** Instructional Design in Mathematics

**Course Code :** MTH6133

**Department :** Mathematics and Information Technology

**Credit Points :** 3

**Contact Hours :** 39

**Pre-requisite(s) :** Nil

**Medium of Instruction :** English supplemented with Chinese

**Course Level :** 6

**Part II**

The University’s Graduate Attributes and seven Generic Intended Learning Outcomes (GILOs) represent the attributes of ideal EdUHK graduates and their expected qualities respectively. Learning outcomes work coherently at the University (GILOs), programme (Programme Intended Learning Outcomes) and course (Course Intended Learning Outcomes) levels to achieve the goal of nurturing students with important graduate attributes.

In gist, the Graduate Attributes for Undergraduate, Taught Postgraduate and Research Postgraduate students consist of the following three domains (i.e. in short “PEER & I”):

* **P**rofessional **E**xcellence;
* **E**thical **R**esponsibility; **&**
* **I**nnovation.

The descriptors under these three domains are different for the three groups of students in order to reflect the respective level of Graduate Attributes.

The seven GILOs are:

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| 1. Problem Solving Skills |
| 2. Critical Thinking Skills |
| 3. Creative Thinking Skills |
| 4a. Oral Communication Skills |
| 4b. Written Communication Skills |
| 5. Social Interaction Skills |
| 6. Ethical Decision Making |
| 7. Global Perspectives |

1. **Course Synopsis**

This course introduces students to the basics of mathematics teaching. Curriculum reform around the world has come to a consensus that mathematics education should prepare students to be competent mathematical problem solvers as well as critical thinkers. To this end, covering the whole syllabus and working on a variety of mathematical problems do not constitute of whole spectrum of work of a professional mathematics teacher. Coupled with sound mathematical knowledge, mathematics teachers are expected to facilitate students to develop meanings for and from their mathematical experiences. This course seeks to equip teachers with the necessary background knowledge and skills to accomplish this.

1. **Course Intended Learning Outcomes** (CILOs)

*Upon completion of this course, students will be able to:*

CILO1 demonstrate an ability to plan lessons according to contemporary goals of mathematics education and results of educational research.

* + - * 1. be able to prepare lesson plans that captures important aspects of mathematics lessons.
        2. be able to locate resources and ideas that would facilitate effective lesson planning.
        3. be able to organize teaching units in such a way that connections between lessons as well as across different curriculum topics are fully addressed.

CILO2 develop basic teaching skills in applying technology to meet the needs of school students.

1. demonstrate basic skills in teaching through dynamic geometry environment.
2. **Content, CILOs and Teaching & Learning Activities**

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| **Course Content** | **CILOs** | **Suggested Teaching & Learning Activities** |
| Modern goals of mathematics education and the role of a mathematics teacher | *CILO1-1* | Lecture |
| Instructional planning for mathematics lessons | *CILO1-1* | Lecture and workshop |
| Information technology environment for the teaching of mathematics | *CILO2-1* | Workshop |
| Research and professional journals as resources for the instructional design | *CILO1-2* | Lecture and workshop |
| The teaching of problem solving | *CILO1-3* | Lecture |
| The teaching of mathematics concepts | *CILO1-3* | Lecture |
| The teaching of mathematics theorems | *CILO1-3* | Lecture |
| Planning for a teaching unit | *CILO1-3* | Lecture and workshop |

1. **Assessment**

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| **Assessment Tasks** | | **Weighting (%)** | **CILO** |
| (a) | Quiz | 15 | *CILO1,2* |
| (b) | Group presentation: Participants will present and discuss the learning and teaching of a selected topic in school mathematics. Special emphasis is on developing students’ conceptual understanding of such topic. | 15 | *CILO1,2* |
| (c) | An individual essay (about 3000 words) on the planning of a mathematical topic with special emphasis on the development of conceptual understanding and higher order thinking. | 70 | *CILO1,2* |

1. **Required Text(s)**

Nil

1. **Recommended Readings**

**Main References:**

Leung, A. & Baccaglini-Frank, A. (Eds.) (2017). *Digital Technologies in Designing Mathematics Education Tasks – Potential and Pitfalls* (Mathematics Education in the Digital Era Book Series). Berlin: Springer.

Watson, A. & Ohtani, M. (Eds.) (2015). Task design in mathematics education: An ICMI study 22. Cham: Springer International Publishing.

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French, D. (2004). *Teaching and learning geometry: Issues and methods in mathematical education*. London: Continuum.

Giles, G., & Association of Teachers of Mathematics. (2002). *Proof in elementary geometry: Making sense of mathematics.* Derby [England]: Association of Teachers of Mathematics.

Johnston-Wilder, S., Mason, J., & Open University. (2005). *Developing thinking in geometry*. London: Open University: In association with Paul Chapman Publishing.

Karp, K. & McDuffie, A. R. (2014). *Annual Perspectives in Mathematics Education 2014: Using Research to Improve Instruction*, Reston, VA: NCTM

King, J.R., &Schattschneider, D. (1997). *Geometry turned on! : Dynamic software in learning, teaching, and research*. Washington, D.C.: Mathematical Association of America.

Kitchen, R.S., Depree, J., Celedon-Pattichis, S., & Brinkerhoff, J. (2007). *Mathematics education at highly effective schools that serve the poor: Strategies for change*. Mahwah, NJ: Lawrence Erlbaum Associates.

Laurillard, D. (2012) *Teaching as a Design Science: Building Pedagogical Patterns for Learning and Technology*, New York/London: Routledge.

Lewis, C. (2002). Does Lesson Study have a future in the United States? *Nagoya Journal of Education & Human Development*, *1*, 25.

Mason, J., Graham, A., Johnston-Wilder, S., & Open University. (2005). *Developing thinking in algebra*. London: Paul Chapman.

Malloy, C. (2009). *Mathematics for Every Student: Responding to Diversity in Grades 9-12*. Reston, VA: NCTM.

Muschla, J. A., &Muschla, G. R. (2003). *Algebra teacher's activities kit: 150 ready-to-use activities with real-world applications*. San Francisco, Calif.: Jossey-Bass.

Nasir, N. S., Cabana, C., Shreve, B., Woodbury, E, & Louie, N. (2014). *Mathematics for Equity: A Framework for Successful Practice (Multicultural Education)*, New York, NY: Teachers College Press.

Posamentier, A. S. (2000). *Making geometry come alive! Student activities & teacher notes*. Thousand Oaks, Calif.: Corwin Press.

Posamentier, A. S., Smith, B. S. &Stepelman, J. (2014). *Teaching secondary mathematics: techniques and enrichment units* (9th ed.). Columbus, Ohio: Merrill Prentice Hall.

Watanbe, T. (2002). Learning from Japanese Lesson Study. *Educational Leadership*, *59* (6).

White, A. L., &Southwell, B. (2003). *Lesson study project: Evaluation report*. Sydney: Department of Education and Training.

香港教育署數學組2000。《中學數學科輔導教學》。香港教育署。

香港教育署數學組2001。《培養高層次思維能力》。香港教育署。

香港教育署數學組2001。《照顧學習差異》。香港教育署。

香港教育署數學組2001。《運用資訊科技》。香港教育署。

香港教育署數學組2002。《度量、圖形與空間範疇第三學習階段》。香港教育署。

香港教育署數學組2002。《數與代數範疇第三學習階段》。香港教育署。

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蔣聲、陳瑞琛2002。《趣味幾何考腦筋》。香港智能敎育。

蔣聲、陳瑞琛2002。《趣味算術考腦筋》。香港智能敎育。

[蔡聰明](http://library.ied.edu.hk/search/a%7b215572%7d%7b215276%7d%7b214321%7d%2C+1947-/a15%7b215572%7d17%7b215276%7d08%7b214321%7d+1947/-2,-1,0,B/browse)2000。《數學的發現趣談》。台北三民。

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唐瑞芬、朱成杰編2001。《數學教學理論選講》。上海華東師範大學。

沈翔、趙小平、唐合太編2001。《用高中數學解日常生活中的問題》。台北九章。

黃毅英編2005。《迎接新世紀重新檢視香港數學教育蕭文强教授榮休文集》。香港香港數學教育學會。

黃毅英 (主編) (2013)。《數學百子櫃系列(十四) 》。數學教師不怕被學生難倒了!-中小學數學教師所需的數學知識。香港:教育局課程發展處數學教育組。

楊弢亮1992。《中學數學教學法通論》。台北九章。

張奠宙、戴再平編2001。《用國中數學解日常生活中的問題》。台北九章。

1. **Related Web Resources**

<http://illuminations.nctm.org/>

<http://www.schoolmath3d.org/e/teacher/index.htm>

<http://www.math.ntnu.edu.tw/index-c.html>

<http://www.geogebra.org/cms/>

<http://www.hkame.org.hk/html/modules/news/>

1. **Related Journals**

Journal of Mathematics Teacher Education

<http://www.springerlink.com/content/1386-4416>

The American Mathematical Monthly

<http://www.jstor.org/action/showPublication?journalCode=amermathmont>

The Mathematics Teacher

The Australian Mathematics Teacher

《數學教育》

1. **Academic Honesty**

The University adopts a zero tolerance policy to plagiarism. For the University’s policy on plagiarism, please refer to the *Policy on Academic Honesty, Responsibility and Integrity with Specific Reference to the Avoidance of Plagiarism by Students* (<https://www.eduhk.hk/re/modules/downloads/visit.php?cid=9&lid=89>). Students should familiarize themselves with the Policy.

1. **Others**

Nil

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