

## STEAM Education in Early Years Syllabus

- Lecturer: Ching-Ting Hsin/ Professor
- Email: cthsin@mx.nthu.edu.tw
- Time: Monday 7 8 (15:30-17:20)
- Classroom: N201, Nanda Campus

- Class description

The purposes of this class are to help students to understand how to design and implement inquiry-based STEM activities and projects. Standards of early science in U.S. and Taiwan are introduced. Four approaches guide students to design their curriculum: (1) theme-based STEM activities, (2) learning center STEM activities (3) project-based STEM module, and (4) culturally integrated STEM module. Students will use their knowledge and skills that they learn in this class to develop lesson plans and guide kindergarteners to conduct STEM activities. Students will also develop STEM projects.

師培 專業 素養 指標	<p>3. 規劃適切的課程、教學及多元評量</p> <p>3-2 依據課程綱要/大綱、課程理論及教學原理，以協同發展跨領域/群科/科目課程、教學及評量。</p> <p>3-3 具備任教領域/群科/科目所需的專門知識與學科教學知能，以進行教學。</p> <p>5. 認同並實踐教師專業倫理</p> <p>5-3 透過教育實踐與省思，以發展溝通、團隊合作、問題解決及持續專業成長的意願與能力。</p>
師培 課程 核心 內容	<p>3-(4) 幼兒園領域專門知識與教學知能</p> <p>5-(1) 教師自我省思、溝通互動與解決問題</p>
融入 議題	<p>12 年國教 19 項議題融入</p> <ul style="list-style-type: none"> <li>● 資訊素養與倫理</li> <li>● 科技教育</li> <li>● 原住民族教育</li> </ul> <p>新興議題</p> <ul style="list-style-type: none"> <li>● 媒體識讀</li> </ul>

- Weekly schedule

week	Date	Topic	Reading/assignments
1	2/19	Introduction and grouping Pretest: self-efficacy and outcome expectation in teaching science	
2	2/26	Introduction to STEM Education: Content of STEM STEM activities (Taiwan and Thailand)	Moomaw C1 (Hsin, Li, & Tsai, 2014; Hsin et al, 2023)
3	3/4	Effective teaching Inquiry cycle Scientific and engineering practices	Moomaw C1 Gelman et al C3 (Haus der kleinen Forscher Foundation, 2017; Hsin & Wu, 2011, 2023)
4	3/11	STEM activities for learning centers Haus der Kleinen Forscher (Little Scientists' House) Program: the theme of technology: forces and effects; lights, colors and vision; water & air	Moomaw C2 HsinLab website Handouts <a href="#">Teaching demonstration</a>
5	3/18	Guideline for ECE and care in Taiwan: Cognitive domain Haus der Kleinen Forscher (Little Scientists' House) Program: the theme of technology: forces and effects; lights, colors and vision; water & air	Handouts
6	3/25	Expert talk: Programing	<a href="#">Turn in notes and questions of the talk</a>
7	4/1	Computational thinking Languages learning AI	PPT
8	4/8	Driving questions for investigation Project approach: airplane, ice, tree, movie, quilts	Krajcik & Czerniak, C3 C4 Helm & Katz, C1 C9 Moomaw C5
9	4/15	<a href="#">Mid-term exam</a> Design and prepare for teaching STEM in a kindergarten: develop lesson plans	

10	4/22	Design and prepare for teaching STEM in a kindergarten: rehearsal and revised lesson plans	
11	4/29	Teaching a STEM activity in Hsinchu City Kindergarten 新竹市士林北路 36 號 2:20pm depart from Nanda campus 3:10-3:40pm activity	
12	5/6	Example of STEM projects: spinning tops, projects on Hsinlab website	PPT HsinLab website
13	5/13	Example of STEM projects: respiratory diseases Culturally integrated STEM projects: Tom Yum Kung	PPT Video clip Turn in lesson plans and reflection
14	5/20	Development of STEM projects	
15	5/27	Present STEM projects Posttest: self-efficacy and outcome expectation in teaching science	
16	6/3	Review of the class	Turn in STEM projects

- Teaching methods

Lectures, small group discussion, classroom activities, teaching STEM in a kindergarten, presentations of STEM projects

- Assignments and evaluation

1. STEM activity and project teaching demonstration (20%) 3/11  
Choose 3-4 members to form a group. Each group presents 10-15 minutes.
2. Mid-term exam (20%) 4/15
3. A lesson plan and reflection on a STEM activity (25%) due 5/13
  - Choose 4-5 members to form a group.
  - For the lesson plan: Modify the lesson plan according to your teaching. Present the best lesson plan. Write the lesson plan in detail. Consider the requirements for the lesson plan (i.e., inquiry cycle, questions/sentences you use to guide children, at least two STEM disciplines)
  - For the reflection, 1 page (Word document), 12-point-font, single-spaced. Consider the following questions when writing: What are the differences between the lesson plan and the actual teaching? What are the activities/sentences/questions you added or removed and what are the

reasons? What are the strengths of your teaching? What are the things that you can improve? Do you achieve your objectives and what are the evidences? What have you done or what do you need to do to achieve the objectives? What do you learn from this activity?

4. The web of concepts and activities of the STEM project (25%)  
Group work, 3-4 pages (Word document), single space, due 6/3  
Determine group members by drawing a lottery. Each group has 4-5 members.  
Each group presents 10 minutes on 5/27
5. Attendance and participation in classroom activities (10%)
  - Your engagement in the class is very important for this course. Inform the teacher when you will be absent from the class and ask your classmates' help to catch up the class you missed.
  - The teacher and the TA will supervise your participation in the class. If you are found once not engaged in the class or doing things not related to the class, it will count as 1-hour absence (absent for 2 hours counts as 1 class absence).
  - You are free to use digital devices (laptop/tablet/cell phone) to do things related to the class. If you are found twice that you use digital devices to do things not related to the class, you are not allowed to use digital devices any more.
  - If you are absent for 5 and more classes (including sick, personal, menstrual leaves and no show), you will fail this course.
- Readings
  1. Gelman, R., Brenneman, K., Macdonald, G., & Román, M. (2010). *Preschool pathways to science (PrePS): Facilitating scientific ways of thinking, talking, doing, and understanding*. Paul H. Brookes Publishing.
  2. Haus der Kleinen Forscher (Little Scientists' House) Program
  3. Helm, J. H., & Katz, L. G. (2016). *Young investigators: The project approach in the early years* (3rd ed.). New York: Teachers College, Columbia University.
  4. Krajcik, J. S., & Czerniak, C. M. (2018). *Teaching science in elementary and middle school: A project-based learning approach*. Routledge
  5. Moomaw, S. (2013). *Teaching STEM in the early years: Activities for integrating science, technology, engineering, and mathematics*. Redleaf Press.
  6. ppt and handouts
- References
  1. Haus der kleinen Forscher Foundation. (2017). *Inquiry-based learning in STEM: Science, technology, engineering and mathematics*. Haus der kleinen Forscher

Foundation.

2. Hsin, C.-T.\*, & Wu, H.-K. (2023). Implementing a project-based learning module in urban and Indigenous areas to promote young children's scientific practices. *Research in Science Education*, 53(1), 37-57. <https://doi.org/10.1007/s11165-022-10043-z>. **SSCI**
3. Hsin, C.-T., Wu, H.-K. \*, Liang, J.-C., & Luu, D. T. (2023). Factors predicting kindergarten teachers' integration of science into their teaching in Indigenous areas. *Australasian Journal of Early Childhood*, 48(1), 50-65. <https://doi.org/10.1177/18369391221120956> **SSCI**
4. Hsin, C.-T., Li, M.-C.\*, & Tsai, C.-C. (2014). The influence of young children's use of technology on their learning: A review. *Educational Technology and Society*, 17(4), 85-99. **SSCI**
5. Hsin, C.-T., & Wu, H.-K\*. (2011). Using scaffolding strategies to promote young children's scientific understandings of floating and sinking. *Journal of Science Education and Technology*, 20(5), 656-666. **SSCI**
6. 辛靜婷、吳心楷 (2021)。探究取向幼兒 STEM 方案課程：設計、教學與評量。心理出版社。