COURSE SYLLABUS

Institute for Innovative Learning, Mahidol University

ILSE 613 Innovations in Science and Technology Education (M.Sc.)

Semester B (2022), 3 (1-4-4) credit hours

Course coordinator:

Supan Yodyingyong (Ph.D. in Science and Technology Education)

Office: Institute for Innovative Learning, Panyaphiphat Building, Smart Classroom

Email: supan.yod@mahidol.edu

Instructors:

Khajornsak	Buaraphan	(KB)	Ph.D.(Science Education)	khajornsak.bua@mahidol.ac.th
Monamorn	Precharattana	(MP)	Ph.D.(Physics)	monamorn.teaching@ gmail.com
Namkang	Sriwattanarothai	(NS)	Ph.D.(Science and Technology Education)	namkang.sri@mahidol.edu
Parames	Laosinchai	(PL)	Ph.D.(Science and Technology Education)	parames.lao@mahidol.edu
Patcharapan	Siriwat	(PS)	Ph.D.(Education)	patcharapan.sir@mahidol.edu
Pirom	Chenprakhon	(PC)	Ph.D.(Science and Technology Education)	pirom.che@mahidol.ac.th
Piyachat	Jittam	(PJ)	Ph.D.(Science and Technology Education)	pjittam@gmail.com
Suchai	Nopparatjamjomras	(SN)	Ph.D.(Science and Technology Education)	suchai.nop@mahidol.ac.th
Supan	Yodyingyong	(SY)	Ph.D.(Science and Technology Education)	supan.yod@mahidol.edu
Suthiporn	Sajjapanroj	(SS)	Ph.D.(Education)	suthiporn.saj@mahidol.edu
Tinnapob	Phengpom	(TP)	Ph.D. (Systems Engineering)	Tinnapob.phe@mahidol.edu
Wararat	Wongkia	(WW)	Ph.D.(Science and Technology Education)	wararat.won@mahidol.ac.th
Watcharee	Ketpichainarong	(WK)	Ph.D.(Science and Technology Education)	watcharee.ket@mahidol.edu

Course Description:

Principle, concept, design, and application of media, innovation, and information technology for learning science, mathematics, and technology; morals and ethics in the development of innovation in science and technology education; morals and ethics in using innovation to develop learning processes in science, mathematics, and technology; evaluation of media, innovation, and information technology for learning

Course Learning Outcomes:

The learners should be able to

Course Learning Outcome (CLO)	ELO	Sub-ELO
1. Apply knowledge in science, mathematics, computer, or other to develop a new instructional material (such as apparatus, experiment, or media) to promote students had better understanding of the concept	2	2.1-2.2
	5	5.1-5.3
2. Apply knowledge in education to design appropriate learning process integrated with the develop instructional material to enhance student's learning	2	2.1-2.2
	4	4.1
	5	5.1-5.3
3. Evaluate the developed instructional material for effective learning	2	2.3, 2.4
	4	4.1
	5	5.3, 5.4
4. Enhance your in-depth conceptual understanding of scientific/mathematics, other concepts-related topics	6	6.1-6.4
5. Have morals and ethics in the development of innovations in science, mathematics, and technology education	1	1.1, 1.2
6. Have morals and ethics in developing of the learning process in science, mathematics, and technology	1	1.1, 1.2
7. Display self-control in class and in doing assignments	7	7.1

Readings:

The readings assigned for this course consists of articles drawn from the former literature of science and technology education. The examples of journals recommended in this course are

- Science (http://www.sciencemag.org/journals/)
- Nature(http://www.nature.com/nature/index.html)
- Research in Science and Technology Education
- International Journal of Science and Mathematics Education
- Biochemistry and Molecular Biology Education
- Educational Technology Research and Development
- Innovations in Education and Teaching International
- International Journal of Technology and Design Education
- Education and Information Technologies
- Life Science Education
- Nurse Education Today
- Journal of Cell Biology Education
- Journal of Chemistry Education
- The Physics Teachers
- Computer & Education
- Journal of Computer Assisted Learning
- Expert Systems with Applications
- Innovative Higher Education

Class Schedule:

Wednesday and Friday (09.00-15.00) Smart Classroom

(Online learning is also available for oversea students and in any circumstances face-to-face meeting are not possible)

Online: WebEx Meeting

- Meeting link: https://mahidol.webex.com/mahidol/j.php?MTID=m0f2a23c01ced33d5c3e6c50e72e6dae4
- Meeting number: 2642 330 6985
- Password: ILSE
- Host key: 897592

Week	Date	Topic	CLO	Teaching approach	2022
1*	11 Jan 2023	Introduction to course Introduction to innovations in science, mathematics, and technology educations	1, 6, 7	Lecture; Discussion	PJ, SY All staff
2*	18 Jan 2023	Searching and analyzing previous research on innovations in science, mathematics, and technology educations	1, 5	Lecture; Discussion; Case study	PL, PJ SY, SN
3*,**	27 Jan 2023	*Students presentation*: Lesson learned from prior work *After Action Review*	1, 5	Lecture; Discussion	All staff
4*,**	3 Feb 2023	*Students presentation*: Emerging idea in educational innovation– *Coaching & Mentoring*	1, 2, 3, 5	Discussion; Coaching & Mentoring	All staff
5	8 Feb 2023	Group meeting Doing a literature review – *Coaching & Mentoring*	1, 2, 3, 5	Discussion; Coaching & Mentoring	All staff

Week	Date	Topic	CLO	Teaching approach	2022
6	15 Feb 2023	Group meeting Designing an educational innovation – *Coaching & Mentoring*	1, 2, 3, 5	Discussion; Coaching & Mentoring	All staff
7**	24 Feb 2023	*Students presentation:* Propose an educational innovation *After Action Review*	2-7	Discussion	All staff
8	1 Mar 2023	Reflections on your project proposal	4, 6, 7	Lecture; Discussion	KB, SY
9	8 Mar 2023	Group meeting Lesson learned & Redesign – *Coaching & Mentoring*	2-7	Discussion; Coaching & Mentoring	All staff
10	15 Mar 2023	*Self-study:* Constructing an educational innovation	2-7	-	-
11	22 Mar 2023	Group meeting R&D the educational innovation – *Coaching & Mentoring*	2,-7	Discussion; Coaching & Mentoring	All staff
12**	31 Mar 2023	*Students presentation:* Work progression *After Action Review*	2-7	Discussion	All staff
13	5 Apr 2023	- How to write a summary of project (*Submit 3 days before selling the products)* - How to sell the product	1-8	Lecture; Discussion; Case study	NS, PJ, SY
14	19 Apr 2023	Group meeting Getting feedback on a summary of project & Preparing to sell the product – *Coaching & Mentoring*	2-7	Discussion; Coaching & Mentoring	All staff
15**	28 Apr 2023	*Exhibition:* Selling the product *After Action Review*	2-7	Discussion	All staff

**Weeks 1-4 are* online class.

***Weeks 3, 4, 7, 12, and 15* are on Friday.

Class Attendance (10%) and Participation (10%) – (CLO 8)

Each student is expected to participate actively in the class. The active participation will be, for example, questioning, sharing, discussing, questioning, participating in the learning activity, and working cooperatively.

Course Assignments

- ***Assignment 1: Analyze the short coming research or practice (5%) – WEEK 2-3* – (CLO 1, 5)**

You are required to read and analyze previous research on innovation in science, mathematics, and technology education to understand the process on developing the particular innovation. You are required to a 15-min presentation of what you have learnt as well as an idea to make it better on week 3. The presentation should cover the following topics;

- Why was it developed?
- Why the researcher(s) selected a particular type of innovation?
- What was the knowledge/information that researcher(s) needed to know before developing it?
- Research process?
- Is there evidence that shows the quality of the developed innovation? Explain

- ***Assignment 2: Propose the idea for development of an educational innovation (15%) – WEEK 4-7* – (CLO 1, 2, 3, 5)**

Each student is required to develop a proposal on the development of an educational innovation in science, mathematics, or technology education and perform a 15-min presentation on week 7.

- ***Assignment 3: Develop an educational innovation (60%) – WEEK 9-14* – (CLO 2-7)**

Each student is required to develop the innovation as proposed.

Note:

(1) The student will have group meeting with IL instructors for consulting.

(2) The budget will be given upon passing the proposal (1,000 baht each)

(3) The student will have a 15-min presentation of work progression on week 12 (20%)

(4) The student is required to write one-page summary of the developed innovation (20%) and then submit to course coordinator at least 3 days before the selling the product

(5) The students will sell the developed innovation on weeks 15 (All styles are welcome!) (20%)

Assessments

Class attendance	10 %	
Active participation in class	10%	
Analyze the short coming research	5%	*Assignment 1*
Proposal on development of an educational innovation	15%	*Assignment 2*
Present work progression	20%	*Assignment 3*
Present the final work (Selling the product)	20%	
One-page summary of the project	20%	

Final grade in the course will be determined by the total points earned, that is,

≥ 90-100%	=	A
≥ 80-89%	=	B+
≥ 70-79%	=	B
≥ 60-69%	=	C+
≥ 50-59%	=	C

In addition, a student's final grade may be higher than the suggested guideline if the student's score is close enough (< 1% gap) to the next high score. That is, close scores will likely earn the same final grade.

Important remark:

1. For credit students to get an evaluation, they must attend at least 80% of class time.

2. For audit students to get a passing grade, they must attend at least 80% of class time with active participation as the same as credit students. Also, the assignment given by instructors has to be included in this evaluation

Evaluation Sheet for Assignment 1: Analysis of Previous Research
ILSE613 Innovations in Science and Technology Education

Evaluated by……..

Criteria	**Name of student**
Show the history of the development of innovations in the chosen topic (5 scores)	
Show ability to analyze strengths and weaknesses of the existing innovations (5 scores)	
Show ability to adapt or apply existing innovations in the chosen topic in a new, better way (5 scores)	
Ability to clarify ideas through Q&A (3 scores)	
Time management (2 scores)	
Total (20 scores)	

Evaluation Sheet for Assignment 2: Propose an Educational Innovation
ILSE613 Innovations in Science and Technology Education

Evaluator:……..

Criteria	Name of student
Ability to analyze literature to find the *GAP*s e.g. *Strengths* and *Weaknesses* of the existing innovations (5 scores)	
Ability to propose educational INNOVATION (New & Better & More Useful ways or things) of the chosen topic (5 scores)	
Ability to support the proposed educational INNOVATION with strong, valid and reliable evidence (5 scores)	
The degree of innovative ideas in the proposed educational INNOVATION (e.g. ranged from Very similar to the existed innovation □□ Very new) (5 scores)	
Ability to clarify and argue his/her proposed educational innovation through argumentation-based Q&A (5 scores)	
Ability of visual aids and/or media used to help the presentation be more supported and powerful (3 scores)	
Effective time management (2 scores)	
Total (30 scores)	

Evaluation Sheet for Assignment 3: Presentation of Work Progression
ILSE613 Innovations in Science and Technology Education

Evaluator: ……..

Criteria	Name of student
Ability to analyze literature to find the *GAP*s e.g. *Strengths* and *Weaknesses* of the existing innovations (5 scores)	
Ability to improve the proposed educational INNOVATION (New & Better & More Useful ways or things) comparing to the previous version (5 scores)	
Ability to support the proposed educational INNOVATION with strong, valid and reliable evidence (5 scores)	
The degree of innovative ideas in the proposed educational INNOVATION (e.g. ranged from Very similar to the existed innovation □□ Very new) (5 scores)	
Ability to clarify and argue his/her proposed educational innovation through argumentation-based Q&A (5 scores)	
Ability of visual aids and/or media used to help the presentation be more supported and powerful (3 scores)	
Effective time management (2 scores)	
Total (30 scores)	

Evaluation Sheet for Assignment 3: Final Presentation of Innovation
ILSE613 Innovations in Science and Technology Education

Evaluator: ……..

Criteria	Name of student
Gap Analysis (5 scores) Refer to some related papers (focus on weaknesses of existing innovation)	
From the Start to the End (10 scores) o Present PREVIOUS versions) and their improvement o Present the CURRENT VERSION o Show the EFFECTIVENESS of innovation through empirical evidence (e.g. result from the try-out with a small sample, result of new lab, etc.)	
Ability to Sell (5 scores) Identify why the audience should pay attention to his/her innovation	
Contribution (5 scores) Identify the CONTRIBUTION of innovation to the related field	
Further Improvement (5 scores) State how to IMPROVE his/her innovation in the future	
Originality (5 scores) Partially show new feature/ process in the presented product	
Clarification (3 scores) Ability to clarify thoughts	
Visual Aids/ Media (1 score) Ability to use visual aids/ media to help the presentation	
Time management (1 score) Finish the presentation within time	
Total (40 scores)	

Evaluation Sheet for Assignment 3: One-Page Summary Report

ILSE613 Innovations in Science and Technology Education

Evaluator: ……..

Criteria	Name of student
1. Introduction (5 points): Determine a brief background and rationale of the work (innovation). Include the significance or contribution of innovation to the field into the report. Also, define the purpose of the work clearly.	
2. Literature Review (5 points): Carefully compare the current work (the developed innovation) to the previous studies. Or clearly state the key improvement to other publications. Key publication(s) has been cited.	
3. Theoretical Framework (5 points): Show key theoretical background appropriately to the development of the work (innovation)	
4. Product (5 points): Provide a concise and precise description of the work (innovation). Also include instruction to use or to learn the concept from the work (innovation). Clearly explain the ways to learn to the concept and purpose(s).	
5. Evaluation (5 points): Determine ways to evaluate the work (innovation). Show the results from the prototype tryout with peers.	
6. Further Improvement (5 points): Determine suggestions to improve the work (innovation) based on prototype tryout data.	
Total (30 scores)	