

COURSE SYLLABUS

Institute for Innovative Learning, Mahidol University

ILSE 606 Mini Project Research in Science

Mathematics and Technology Education

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

Course coordinator

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Course description

Analysis of research in science and technology education; designing of mini research project in science and technology education; components in research development; data collection and analysis; ethics in educational research; writing and presenting research work; teaching an interdisciplinary project

Course learning outcomes

At the end of this course, students will be able to:

Course Learning Outcomes (CLOs)	PLO	Sub-PLO
1. display ethical behavior in conducting educational research	1	1.2
2. discuss an effective way to teach an interdisciplinary project	2	2.1
3. develop a content-oriented mini-research project by applying an effective teaching and learning approach and research methodology	4	4.1
4. construct a plan for project implementation appropriate to answer the research question(s)	4	4.1
5. collect data successfully according to the plan	4	4.2
6. analyze data properly	4	4.2
7. conclude the findings	4	4.3
8. apply ICT to the literature search and communicate to others effectively	4	4.3
9. enhance one's in-depth knowledge to support the development of the mini-research project	6 7	6.1–6.3 7.2
10. display self-control during the development of mini-project research	7	7.1
11. respect others' rights and opinions	8	8.2
12. cooperatively working with peers and instructors	8	8.2

Class period

Wednesday 09.00–15.00 hrs

Place: Panyaphat Building, 3rd floor, room 303

Individual Consult Time: By appointment

(Online learning is also available in any circumstances where face-to-face meetings are not possible)

<https://mahidol.webex.com/mahidol/j.php?MTID=ma3384d448e0168d17926927581aa0bab>

Meeting number: 2644 854 7869

Password: ILSE606

Host key: 334179

Course schedule

Week	CLOs	Date	Mode of Learning ⁺	Topic	Teaching Approach	Assessment/ Assignment	Instructor
1	1, 8, 11, 12	10 Aug 2022	S&A	<ul style="list-style-type: none"> - Introduction and Reflective Journal Writing - Searching - How to Use Mendeley for Managing the References - Citation and Plagiarism 	Lecture; Practice; Discussion	Formative Assessment	NS
2	1,2, 8, 11, 12	17 Aug 2022	S&A	Literature Review and Analysis Articles for Preparing Research Work	Lecture; Discussion; Project-based	Assignment 1	NS
3*	1, 3, 8, 11, 12	26 Aug 2022 (Friday)	S&A	Research Questions & Objectives Practicing from the Selected Topic	Project-based; Discussion	Assignment 2	NS WK
4	1, 3, 4, 11, 12	7 Sep 2022	S&A	Research Design Practicing from the Selected Topic	Project-based; Case study	Formative Assessment	NS WK PJ
5	1–4, 8–12	14 Sep 2022	S&A	<ul style="list-style-type: none"> - Share & Learn: Proposal for Mini Project Research - Critical Reflections and Revised Proposal for Mini Project Research 	Project-based; Discussion	Assignment 3 Journal 1	NS PJ PS WW WK
6	1, 2, 5, 11–12	21 Sep 2022	S&A	<ul style="list-style-type: none"> - How to Manage Class for the Effective Learning Process - Ethical Issues and Considerations in Educational Research 	Case study; Role play; Discussion	Formative Assessment	NS, WK
7	1–8	28 Sep 2022	A	How to Write Academic Paper	Lecture	-	PJ PS NS
8	1–8	5 Oct 2022	A	Practicing in Academic Writing	Project-based	-	PJ PS NS
9	1, 6, 8, 9, 11, 12	19 Oct 2022	S&A	Data Analysis (Quantitative Analysis)	Lecture; Project-based; Discussion	Formative Assessment	WW PS PL

Week	CLOs	Date	Mode of Learning ⁺	Topic	Teaching Approach	Assessment/ Assignment	Instructor
10	1, 6, 8, 9, 11, 12	26 Oct 2022	S&A	Data Analysis (Qualitative Analysis)	Project-based; Discussion	Formative Assessment	WW PS
11	1, 2, 5, 9–12	2 Nov 2022	S&A	After Action Review on Implementation Period	Project-based; Discussion	Journal 2	NS WK
12	1–8, 11, 12	9 Nov 2022	S&A	Revision of Academic Paper	Peer Review; Discussion	Assignment 4	PJ PS NS
13	2, 11, 12	16 Nov 2021	A	From Doing to Teaching: Learn How to Facilitate a Project to be Meaningful Learning	Case study	-	PJ NS WK
14	2, 9, 11, 12	23 Nov 2021	S&A	How to Create Questions-driven Learning in a Project-based Learning	Role play; Discussion;	Formative Assessment	PJ NS WK
15	1–12	30 Nov 2022	S	Summative Assessment: Mini Project Final Presentation and Evaluation	Project-based; Discussion	Final Presentation Journal 3	NS PJ PS WW WK

Remark: * = a class is not on Wednesday

+ = There are two modes of learning in this course: synchronous (S) and asynchronous (A) learning. Synchronous Learning means students and instructor(s) attend a class at the same time and in the same place (either online or onsite), while in Asynchronous Learning, students learn by themselves at different times and spaces. Moreover, the acronym S&A used in this class means a class consisting of synchronous learning during 9–12 hr and asynchronous learning during 13–15 hr. Moreover, A means students can learn based on their paces via a provided lesson in the Edmodo application.

Readings

Required readings

- Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education, 7th ed.* New York: Routledge.
- Joyce, B., Weil, M., & Calhoun, E. (2015). *Models of teaching, 9th ed.* New Jersey: Pearson Education, Inc.
- Ryan, M.E. (2013). The pedagogical balancing act: teaching reflection in higher education. *Teaching in Higher Education 18*(2), 144–155.

Supplementary readings

Supplementary readings are provided as handouts.

Assignment

Class participation (10%)

Students should participate, share, discuss, and suggest their peers' works during class, as shown in the table.

CLOs	Criteria	Present (1)	Attentive (2)	Engaging (3)	Satisfactory (4)	Exemplary (5)
11	Respect for others' opinions in the discussion	<ul style="list-style-type: none"> - Show up but never contribute to the discussion - Lack of attention to the present and/or discussed topic 	<ul style="list-style-type: none"> - Seldom contribute to discussion unless asked - Listen when others discuss and occasionally respond to the discussed topic 	<ul style="list-style-type: none"> - Sometimes contribute to the discussion - Listen when others discuss and sometimes respond to the discussed topic 	<ul style="list-style-type: none"> - Regularly contribute to the discussion - Appropriately listen when others discuss and consistently respond to the discussed topic 	<ul style="list-style-type: none"> - Actively and regularly contribute to the discussion - Appropriately listen when others present and/or discuss and usefully reply to the topic
12	Cooperatively work	Contributes information to peers and instructors only when prompted	Contributes information to peers and instructors with usually prompting or reminding	Contributes knowledge, opinions, and skills to work with peers and instructors with occasional prompting or reminding	Regularly contributes knowledge, opinions, and skills to work with peers and instructors	Consistently and actively contributes knowledge, opinions, and skills to work with peers and instructors without prompting or reminding

Moreover, in weeks 3, 5, and 15, each student has to

1. act as a chairperson/timekeeper to manage the class and/or
2. criticize peers by asking at least one higher-order level question/class and/or
3. give suggestions to peers at least one comment/suggestions/class for improving each others' work

The instructors responsible for the topic will provide the active participation score.

Assignment (50%)

Each student must submit a work regarding the identified topic in a course schedule. Due to instructors' and students' decisions, the assignments must submit to Edmodo on the date. The course instructors responsible for the topic will give each work's score. Details of each assignment and evaluation criteria are as follows:

1. Assignment 1 (1-page A4 of literature review and references) **5%**

Students must analyze at least three research articles and write 1–2 paragraphs (s) of a literature review from the articles. Moreover, in-text citations and references in APA style must be included in the work. You must bring the first version of this assignment to the class on 17 August 2022. After receiving the in-class feedback and suggestion, the revised version should be submitted to Edmodo within 21 August 2022.

Assessment criteria for Assignment 1

CLOs	Criteria	Score	Mark
1	Proper citation and references (APA citation) formatting is used throughout. In addition, each citation matches with reference.	3	
2	Level of communication - All important concepts are concise and well-defined. - Summarizes and shows the insightful synthesis of the literature information, including analysis of gaps and/or limitations of the research. - Paraphrase: The content of each paragraph is closely associated with its topic. Also, the transitions are smooth and logically arranged.	5	
8	An appropriate selection of peer-reviewed research articles is included. All pieces are relevant to the literature.	2	
Total		10	

2. Assignment 2 (5-Page Presentation slide of introduction part) 10%

Each student is required to do a 5-min presentation of the scope for mini project research. The presentation slides are not more than five pages. The presentation slide has to cover (1) a topic, (2) a summary of an interesting topic explaining why should do the research and how to improve it (be criticizing!!), (3) research question(s), (4) research objective(s). You must bring the first version of this assignment to the class on 26 August 2022. After receiving the in-class feedback and suggestion, the revised version should be submitted to Edmodo within 31 August 2022.

Assessment criteria for Assignment 2

CLOs	Criteria	Score	Mark
3	<i>The rationale of the study</i> <ul style="list-style-type: none"> - The rationale must explain why you are interested in that topic with claims or evidence support. - Also, provide significance of the study and/or problem(s) relating to topic. 	7	
3	<i>Research Questions and Objectives</i> <ul style="list-style-type: none"> - The research question(s) and objective(s) represent the frame of the study. - There are also the connections between introduction (rationale of the study), research questions, and research objectives. 	5	
8	<i>Presentation</i> <ul style="list-style-type: none"> - Detailed, relevant, and accurate information is covered. Determine appropriate details for the topic, introduction, research question (s), and research objective (s). Moreover, the topic/title of the presentation reflects the research work. - An oral presentation is logically presented in a way that helps the audience to understand the framework of their research. - On-time presentation (5 minutes only) 	5	
1	There are both in-text citations and references properly provided in the presentation.	3	
Total		20	

3. Assignment 3 (1-page A4 poster of the proposal) **15%**

Each student is required to prepare a 1-page A4 poster presenting (1) the title, (2) significance of the study, (3) research question(s), (4) research objective(s), and (5) methodology, including research design, plan for implementation and plan for data collection and data analysis. The poster will be prepared and handed into the class for discussion in the share & learn session on 14 September 2022. Moreover, the poster file with revision has to submit to Edmodo before midnight on 19 September 2022.

Assessment criteria for Assignment 3

CLOs	Criteria	Score	Mark
3	Title and Introduction <ul style="list-style-type: none"> - Provide the appropriate title of the proposal. - Detailed, relevant, and accurate information is covered in Introduction. - Provide rationales or significance of the study and/or problem(s) relating to topic. 	5	
3	Research Questions and Objectives <ul style="list-style-type: none"> - The research question(s) and objective(s) represent the frame of the study. - There are also the connections between introduction (rationale of the study), research questions, and research objectives. 	5	
4	Research Design: The designed research plan is proper/fits with the research question(s).	2	
2	Research Plan: A brief implementation of your innovation has been included.	5	
4	Data collection and analysis <ul style="list-style-type: none"> - Tools were designed appropriately to gather information for answering the research question(s). - The relevant details for data collection and data analysis are included in the poster. - Examples of tools used in the study have to be presented. 	5	
8	Representation <ul style="list-style-type: none"> - The presentation is logically organized, and the information is clearly explained. - Determine appropriate details such as title, the significance of the study, research objective, research question, research design, participants, implementation plan, data collection plan, and data analysis. - Good visual quality (content displayed well visible, colors, pictures, or even ways of presentation). - The presentation is well divided into sections to convey the content of the study (includes well-adapted pictures/figures/tables/diagrams where the case) - Information is provided in a 1-page poster. 	5	
1	There are both in-text citations and references properly provided in the poster.	3	
Total		30	

4. Assignment 4 (a 3,000-word research article) **20%**

Each student must submit an A4 report (no longer than 3,000 words excluding references) presenting mini-project research. The report has been written academically, including abstract, introduction, methodology, research findings/results, discussion, conclusion, and references. The report must be submitted to Edmodo for practicing on 9 November 2022. Moreover, the revised version has to submit to Edmodo before midnight on 24 November 2022.

Assessment criteria for Assignment 4

CLOs	Criteria	Score	Mark
3	Title: Provide the appropriate title of the article	1	
7	Abstract and Key Words <ul style="list-style-type: none"> - An abstract summarizes the main points of the research article. It is written in a complete but concise description of the study. Summarize the main points of the research article - Keywords are words that represent the key of the study. 	5	
3	Introduction <ul style="list-style-type: none"> - Determine the study's brief background and rationale, including the significance or contribution to the field. Also, define the purpose of the work clearly. - Carefully compare the current work to the previous studies. Essential publication(s) has been cited. - The research questions and research objectives are straightforward and evaluated. 	7	
3, 4	Methodology (Material and Methods) <ul style="list-style-type: none"> - Using appropriate instruments (Data collection & Data analysis) to assess research questions and objectives. It also provides sufficient information for each tool to collect data. - Clearly state the implementation plan and data collection process. - Represent the quality of research methodology in the article. 	5	
5, 6	Research findings and discussion <ul style="list-style-type: none"> - Provide informative details for interpretation of the findings. - Discuss the findings or compare and contrast each result with the previous studies. - Determine suggestions to improve the research based on findings. 	7	
7	Conclusion <ul style="list-style-type: none"> - Specify the priority findings from the research. - Offer recommendations that arise from the research. 	5	
1	References <ul style="list-style-type: none"> - Write with proper reference format (APA style), both in-text citation and references part. - Display the correct number of references. - Each citation matches the reference. 	5	
8	Writing style <ul style="list-style-type: none"> - Writing is clear and concise with a logical arrangement. No longer than 3,000 words (excluded references) - Information is presented so that reader can follow with clear transitions. - Content is comprehensive, accurate, and persuasive. Major points are stated clearly and are well supported. - Plagiarism of less than 20% is acceptable 	5	
Total		40	

A reflective journal (20%)

Each student must write a reflective journal to identify their thoughts and learning growth along the course. According to Ryan (2013), the reflective scale can be classified into 4 R, which are (1) reporting and responding, (2) relating, (3) reasoning, and (4) reconstructing. Each journal has to complete the 4 Rs reflecting their learning practices.

To write the reflective journal effectively, students should start by selecting the critical event and explaining what happened. Then point to the issue or incident involved and interpret them. Next, relate the issue/incident to your skills/experiences/knowledge and provide a reason to support why it is relevant. Finally, conclude what you can learn from the issue/incident and explain how to apply for next time. Students are expected to write a reflective journal on

- 1. Journal 1:** Developing the proposal (5%)
- 2. Journal 2:** Implementation and data collection (5%)
- 3. Journal 3:** Learning from mini-project research (10%)

Each student is required to submit a reflective journal to Edmodo.

Assessment criteria for the reflective journals 1 and 2: 5%

CLOs	Criteria	Score	Mark
9	The reflection covers all 4Rs, which are (1) reporting and responding, (2) relating, (3) reasoning, and (4) reconstructing.	2	
9, 10	Able to demonstrate excellent insights and self-control in their self-reflection.	4	
9	Able to apply past and present experiences to future situations and integrate into different issues from a broad range of perspectives (different contexts, cultures, disciplines, etc).	4	
Total		10	

Assessment criteria for the reflective journal 3: 10%

CLOs	Criteria	Score	Mark
9	The reflection covers all 4Rs, which are (1) reporting and responding, (2) relating, (3) reasoning, and (4) reconstructing.	2	
9, 10	Able to demonstrate excellent insights and self-control in their self-reflection.	4	
9	Able to apply past and present experiences to future situations and integrate into different issues from a broad range of perspectives (different contexts, cultures, disciplines, etc).	4	
9	Able to evaluate self-learning for the whole course	5	
9	Able to suggest ways to improve oneself	5	
Total		20	

Mini Project Final Presentation and Evaluation (20%)

Students must make a 15-min presentation of the final version of their mini projects, followed by instructor comments and evaluations.

Assessment criteria for mini project final presentation and evaluation: 20%

CLOs	Criteria	Score	Mark
3	Title: Provide the appropriate title of the article	1	
3	Introduction <ul style="list-style-type: none"> - Determine the significance or problem of the study. The rationale behind the work has been highlighted, leading the audience to the research questions and objectives. - Review some gaps or limitations from the previous research to point out why this study would be needed in a critical discussion or argument-driven format (not just a summary!!). - The research questions and research objectives are straightforward and evaluated. 	6	
3, 4	Research Methodology <ul style="list-style-type: none"> - The educational research tools used in the study should meet your research questions/objectives. - Clear explanations of research design, data collection, and data analysis. - In addition, an instructional procedure related to the selected teaching/learning approach has been determined in the study that includes lesson implementation. 	6	
5, 6	Results <ul style="list-style-type: none"> - Clear presentation of research findings. - Use the appropriate way of representation such as table, graph, etc. Then, explain how to infer results and draw a conclusion, especially on the effectiveness of the implemented unit toward learning. 	6	
2	Discussion: <ul style="list-style-type: none"> - Discuss the findings or compare them to other research studies. - Provide the further improvement. 	6	
7	Conclusion: Highlight the key findings and states the implications.	4	
1	References: Provide appropriate citations with proper reference format (APA style) throughout a presentation.	5	
1	Acknowledgement: State the indebtedness to others who have helped and supported a mini project	1	
8	Communication skills, Time Management, and Response to questions/ mastery of the subject <ul style="list-style-type: none"> - The presentation is logically organized, and the information is clearly explained (easy to follow). Good visual quality (content displayed well visible, colors, pictures, well-balanced screen, or even ways of presentation). - Adhere to the time requirement (10-min presentation each!). - They are able to answer questions logically and have the ability to think on their feet. 	5	
Total		40	

Deadline for Assignment and Reflective Journal submission

All assignments and reflective journals for the course are summarized in the table.

Item	%	Detail	Submission Deadline (within 11.59 pm via Edmodo)	
			1 st Submission	Revision/Final
Assignment 1	5	1-Page A4: Literature review and references	17 Aug 2022	21 Aug 2022
Assignment 2	10	5-Page Presentation Slide: Title, introduction, research question(s) and objective(s)	26 Aug 2022	31 Aug 2022
Assignment 3	15	1-Page A4 Poster: Proposal	14 Sep 2022	19 Sep 2022
Journal 1	5	Reflection on developing the proposal	20 Sep 2022	23 Sep 2022
Journal 2	5	Reflection on the implementation and data collection	2 Nov 2022	5 Nov 2022
Assignment 4	20	3,000-word Article: Report (excluding references)	9 Nov 2022	24 Nov 2022
Journal 3	10	Reflection on learning from mini-project research	-	2 Dec 2022

Assessment and Evaluation

Item	Detail	%	Assess to CLOs
Class participation		10	11–12
Assignment		50	1–8
Assignment 1	1-Page A4: Literature review and references	5	1, 2, 8
Assignment 2	5-Page Presentation Slide: Title, introduction, research question(s) and objective(s)	10	1, 3, 8
Assignment 3	1-Page A4 Poster: Proposal	15	1–4, 8
Assignment 4	3,000-word Article: Report (excluding references)	20	1–8
Reflective Journal		20	9–10
Journal 1	Reflection on developing the proposal	5	9–10
Journal 2	Reflection on the implementation and data collection	5	9–10
Journal 3	Reflection on learning from mini-project research	10	9–10
Final presentation and evaluation		20	1–8
Total		100 %	

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

$\geq 90\%$	=	A
$\geq 80\%$ and $< 90\%$	=	B ⁺
$\geq 70\%$ and $< 80\%$	=	B
$< 70\%$	=	I

Also, 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 higher score. That is, close scores will likely earn the same final grade.

Important remarks:

1. To get an evaluation, credit students must attend at least 80% class time (12 out of 15 sessions).
2. To get a passing grade, audit students must attend at least 80% of class time (12 out of 15 sessions) with active participation as needed for credit students. Also, audit students must complete assignments given by the instructors.

Appeal:

Please note that any formal appeal made to raise a concern about the courses, including learning, teaching, and assessment methods, as well as the IL program, including facilities and infrastructures, can be made through the Education website (<https://il.mahidol.ac.th/eng/education/>)

Appendix

Table for summary the expected learning outcomes, teaching and learning approach, and summative assessment method used in the course

PLOs	subPLOs	CLOs	Teaching and Learning Method							Summative Assessment Method							Total		
			Lecture	Practice	Discussion	Project-based	Case study	Role play	Peer Review	Class participation	Assignment				Journal			Final Presentation	
											1	2	3	4	1	2			3
1	1.2	1		/		/			/		1.5	1.5	1.5	2.5				3	10
2	2.1	2	/		/	/	/	/	/		2.5		2.5					3	8
4	4.1	3	/		/	/	/		/			6	5	4.5				5	20.5
4	4.1	4	/		/	/	/		/				3.5	2				1.5	7
4	4.2	5				/		/	/					1				1.5	2.5
4	4.2	6				/			/					2.5				1.5	4
4	4.3	7	/		/	/			/					5				2	7
4	4.3	8	/	/	/	/			/		1	2.5	2.5	2.5				2.5	11
6	6.1	9				/		/							1	1	1		3
6	6.2	9				/		/							1	1	1		3
6	6.3	9				/		/									2.5		2.5
7	7.2	9				/									2	2	4.5		8.5
7	7.1	10				/									1	1	1		3
8	8.2	11	/	/	/	/	/	/	/	5									5
8	8.2	12	/	/	/	/	/	/	/	5									5
Total										10	5	10	15	20	5	5	10	20	100

The PLOs and key performance indicators of the Master of Science Program in Science and Technology Education (International Program) in Academic Year 2020.

PLOs	Key Performance Indicators
PLO 1: Display moral and ethical behavior for science and technology educators	1.2 Follow the ethical code of conduct in educational research
PLO 2: Apply principle in science and technology education to design and implement learning activities in science and/or technology classes appropriately	2.1 Adopt instructional sciences to improve learning in science and technology education
PLO 4: Conduct science and technology education research by integrating knowledge in the field of study	4.1 Propose a research project in science and technology education predicated on educational research methodology 4.2 Conduct science and technology education research 4.3 Publish an international peer-reviewed research article
PLO 6: Evaluate knowledge of oneself	6.1 Classify criteria for self-evaluation 6.2 Reflect oneself against the criteria 6.3 Evaluate oneself validly and reliably
PLO 7: Display the ability to control and improve oneself	7.1 Display the ability to control oneself 7.2 Display the ability to improve oneself
PLO 8: Display leadership quality and ability to effectively collaborate with others	8.2 Display ability to effectively collaborate with others