International Seminar on Chemical Education ISCE

الجامعة الإسلامية العالمية ماليزيا
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
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Garden of Knowledge and Virtue

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RCE REGIONAL CENTRE OF EXPERTISE ON EDUCATION FOR SUSTAINABLE DEVELOPMENT
ACKNOWLEDGED BY
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PERCEPTION OF UNDERGRADUATE STUDENTS IN LEARNING ORGANIC CHEMISTRY AT THE KULLIYYAH OF SCIENCE (IIUM): A PRELIMINARY STUDY

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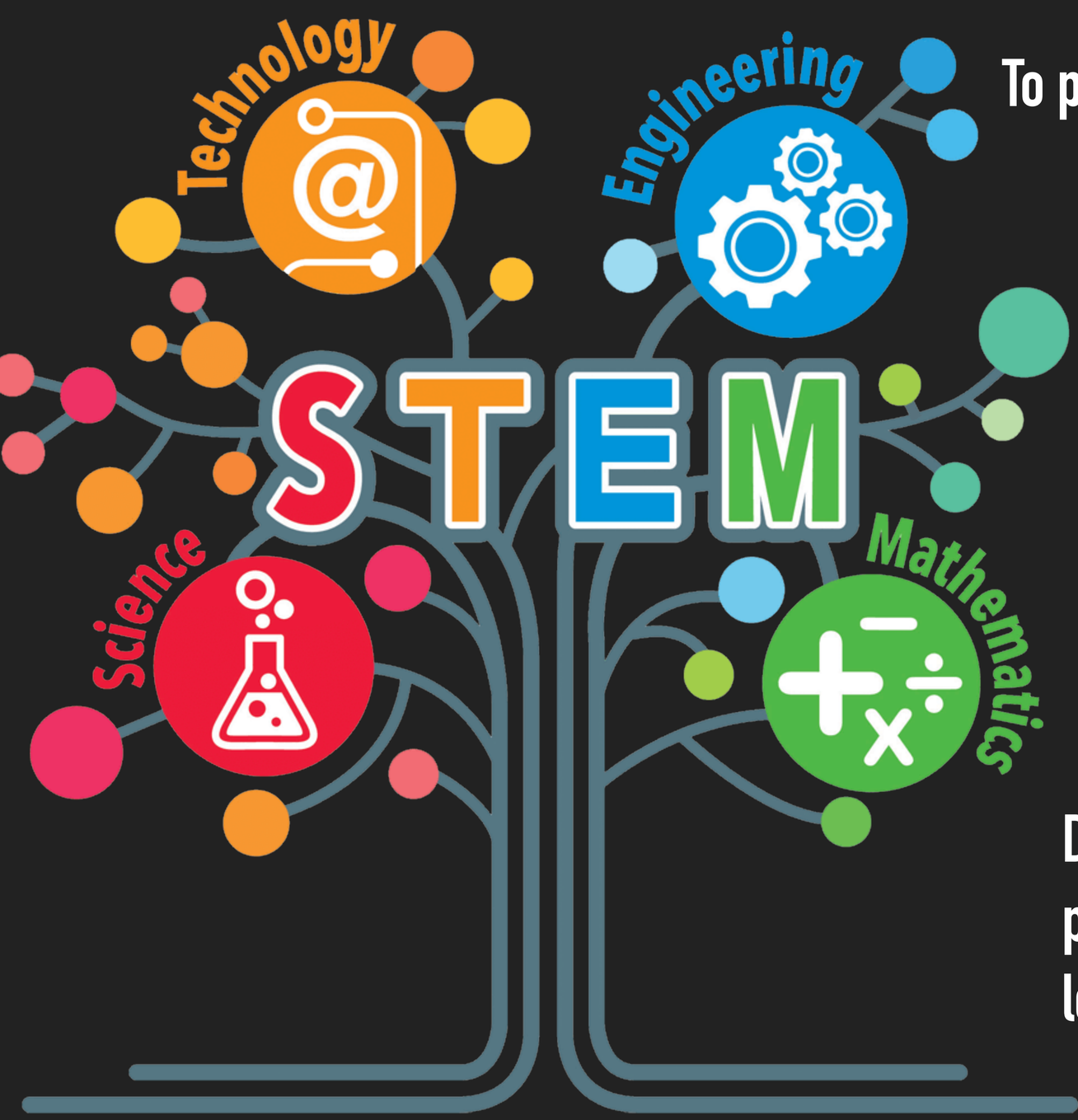
Kulliyyah of Science
IIUM Kuantan Campus

15th September 2021



To produce a scientific and progressive society

For nations' future as well-developed countries

Malaysia should have at least 1/2 million graduates from STEM fields at the higher education level

Decreasing trends of students taking STEM programmes for both in secondary and tertiary levels of education across the world.

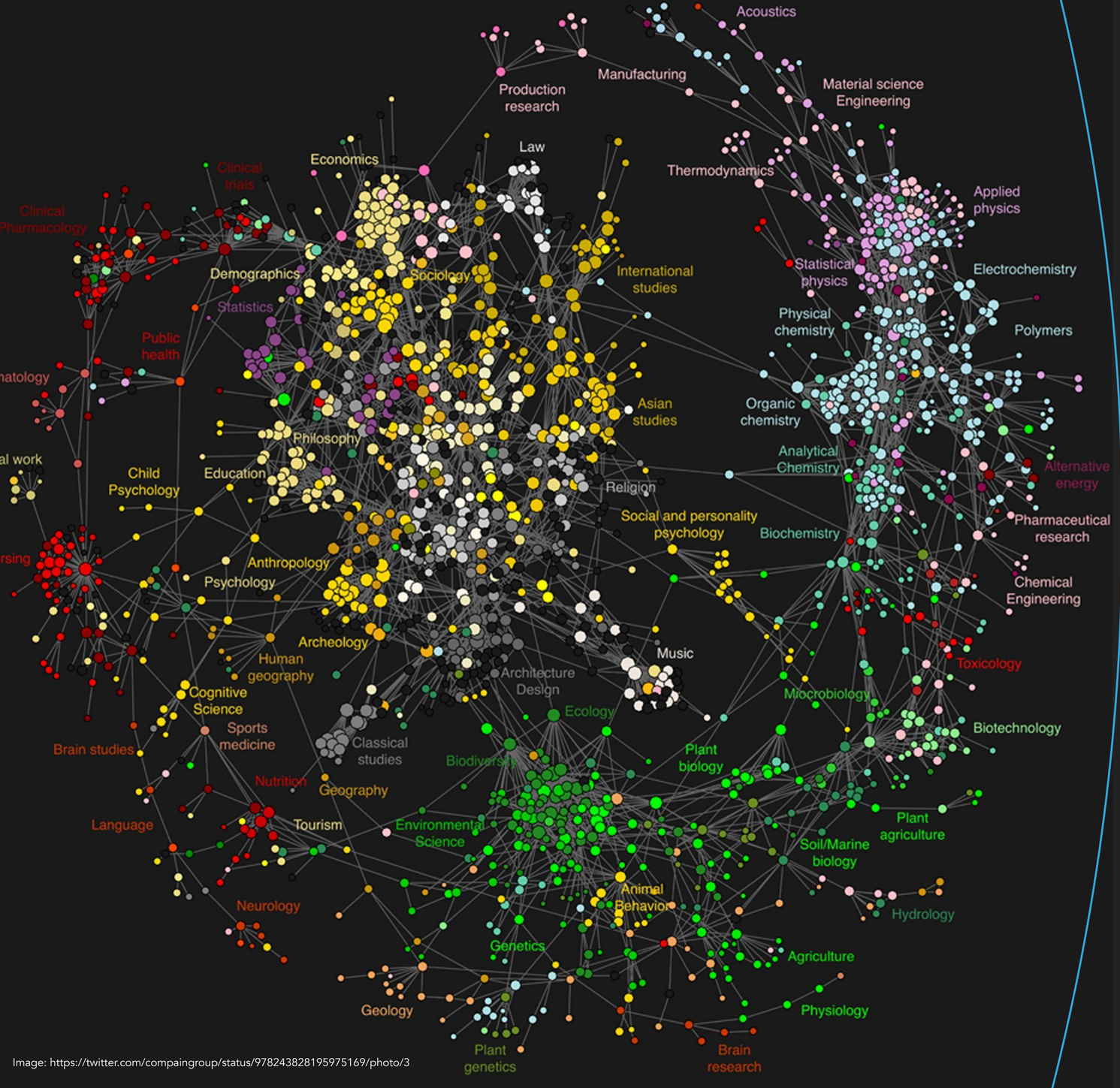


Image: https://twitter.com/compaingroup/status/978243828195975169/photo/3

Chemistry - the central core of science

Knowledge of chemistry is important for those who wish to pursue their career

chemical industry

Medical-related careers

biotechnology

engineering

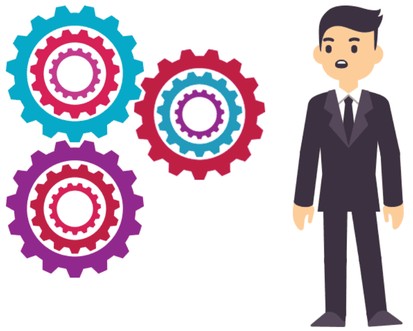
patent law

One of the pre-requisite subjects for most science programmes

ORGANIC CHEMISTRY

Difficult

Demanding



Continuous effort in understanding the flow of the organic reactions

Predicting the product based on the materials & conditions given and vice versa.

Memorising countless conditions

TRENDS OF STUDENTS PURSUING UNDERGRADUATE STUDY IN CHEMISTRY

Number of Students Pursuing Chemistry

perception resulted in a high number of students pulling away from taking chemistry courses either in high school or university levels

Academy of Science Malaysia (ASM) : Malaysia should have 1/2 million S&T graduates at higher education level to achieve Vision 2020

until 2015, the number of graduates in these field of study was only 85,000

60:40 ratio of science students to non-science in education policy

Failure Rate of Organic Chemistry Subject

the highest compared to other subjects

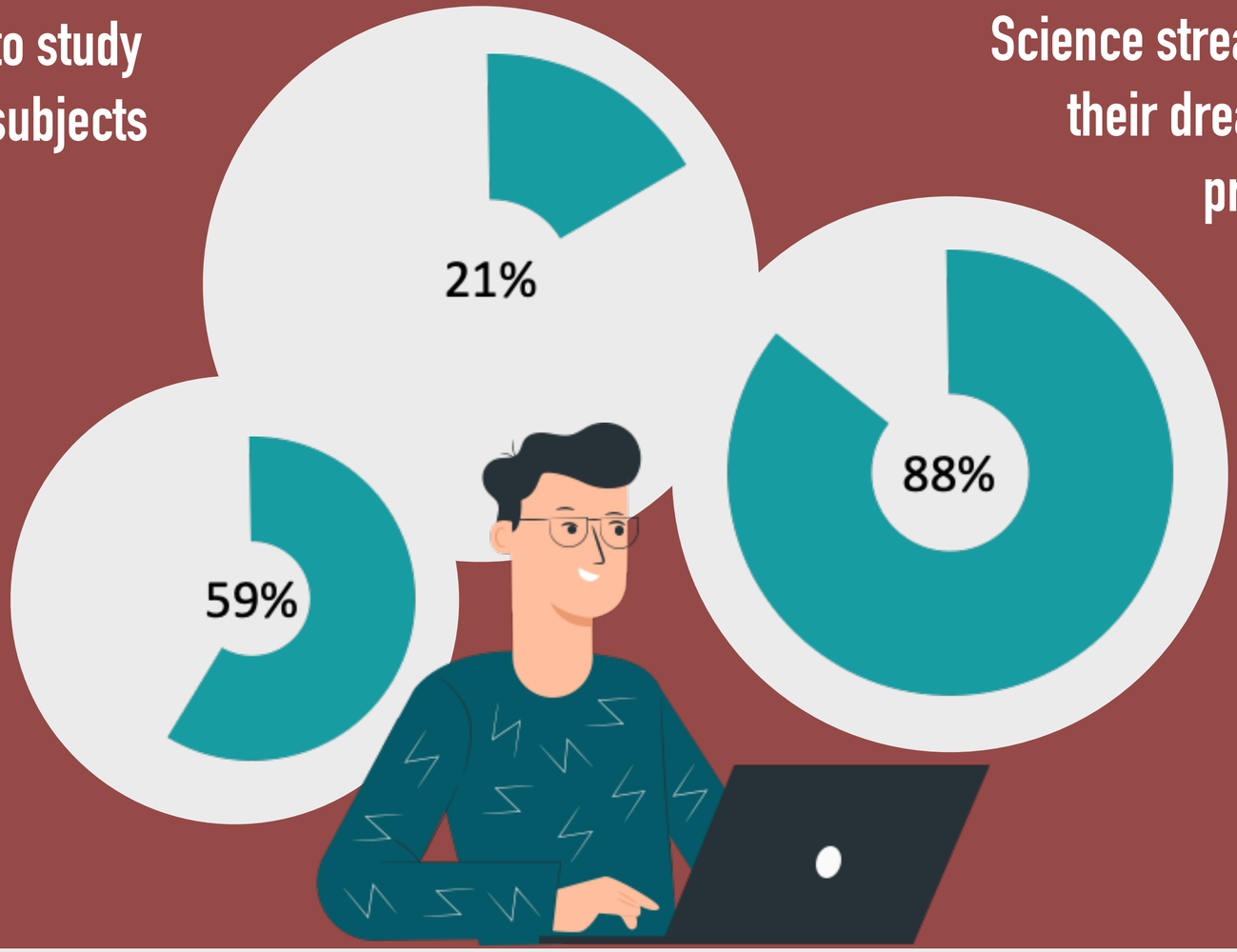
Ahlstrom, D. (2013). Failure rate in science subjects remains high. Retrieved May 16, 2020, from https://www.irishtimes.com /news/education/ failure-rate-in science-subjects- remains-high -1.1494421

Malaysia Scenario

2014:

Upper secondary school level :
Students chose to study science stream subjects

Undergraduate level:
Science stream applicants pursued their dreams in the science programmes.



Academic year of 2015/2016:
Students selected into science programmes at the tertiary level – (95 % accepted the offer)


SUNDAY
Star
the people's paper

world
Ceasefire holds
All quiet on the Syrian battlefront as US-Russian truce is implemented. >25

More science grads

WANTED

Malaysia may not have enough engineers, architects and other professionals to achieve Vision 2020, based on the low level of interest by our students in science, technology, engineering and mathematics. If the situation goes on, Malaysia may have to depend on foreign workers to attain developed status, warn experts. **>See Pages 16 & 17 for reports by CHRISTINA CHIN**

- No record or data found for trend of chemistry subject results in secondary or tertiary level of study in Malaysia.
- 13 % of students obtained C in science subject for their PT3 examination (Pentaksiran Tingkatan 3) in 2015 (Su Lyn, 2015)
- For the past 10 years only around 30 % of students qualified to be enrolled in science-stream class in the upper secondary school level.
- No study done yet in Malaysia specifically to find the difficulties faced by undergraduate chemistry students in learning organic chemistry

Andrew, A. N. (2017, March 12). STEM, a priority for Malaysia. The Star Online. https://www.thestar.com.my/news/education/2017/03/12/stem-a- priority- for-malaysia/

DECLINING STUDENTS' ENROLMENT IN SCIENCE-STREAM PROGRAMMES

Chemistry is a pre-requisite subjects for science-stream programmes

Chemistry as a 'Hard' Subject for Learners to Learn and Understand

Low Motivation Towards Organic Chemistry Subject

DIFFICULTIES IN ORGANIC CHEMISTRY STUDIES AMONG LEARNERS

Weak Understanding on Molecular Models of Compounds

Inter-conversion of 2D and 3D structure.

3D and 2D visualisation & application of computer generated models (e.g Chemscape Chime browser plug-in, and the Jmol java applet) recommended for learning purpose

Ineffectiveness of Teacher-Centred Teaching Method

teaching method practiced for most of science-programme subject is teacher-centred-passive state as the information

approaches are constructivism, problem-based learning (PBL) and concept mapping, digital/ internet

Lack of Critical Thinking Skills in Problem-Solving

complexity of the content in organic chemistry subject increases - topics are related to each other

students need to combine fundamental concept, relate each concept and creativity in designing a well-defined strategy

Misconceptions on Contents of Organic Chemistry Subject

Not obvious for both of lecturers and students - unless when the students try to explain their reasoning on their answers to the teacher.

Lecturers should integrate questions that require students to give reasoning on certain concept in the class activity

DIFFICULT AREAS IN ORGANIC CHEMISTRY SUBJECT

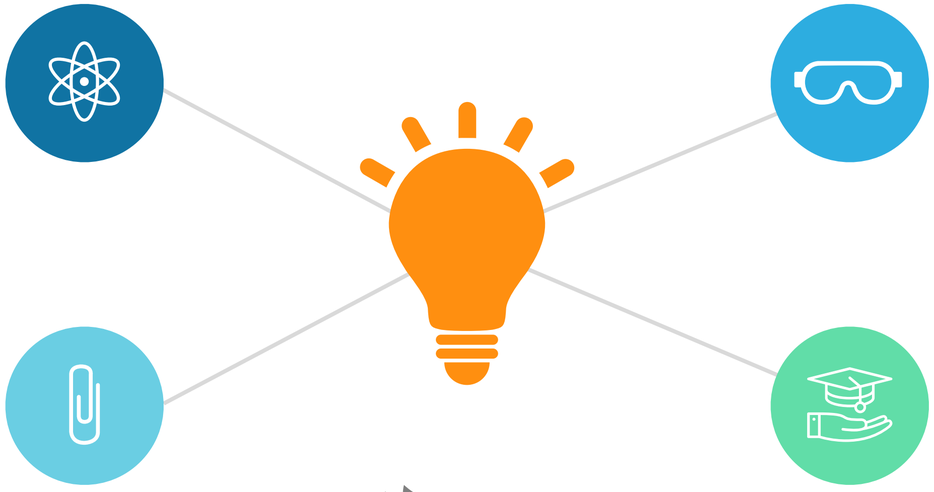
Reaction Type

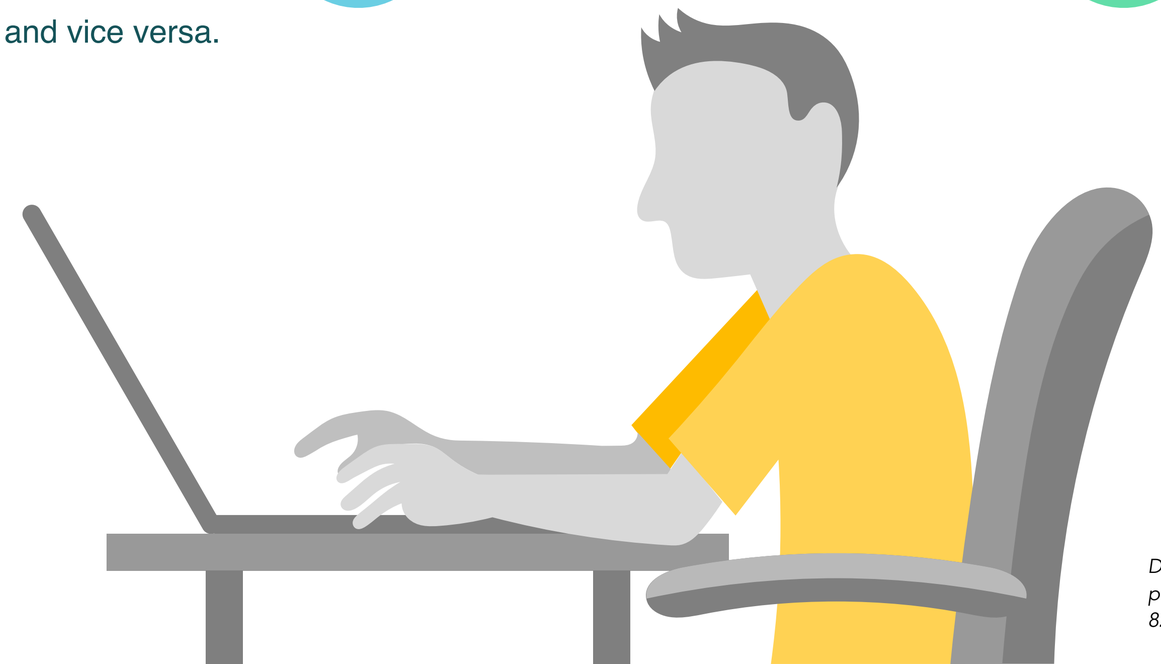
Students tend to memorise what they need to do when encountered question involving identification of reaction type/mechanism.

Determine nucleophile and electrophile based on the given reactants and products

Stereochemistry

Students lack of skills to conceptualise the structure in 3D into 2D forms and vice versa.





Organic Synthesis

Most complex: Organic Chemistry concepts are interconnected with each other

Reaction Mechanism

Weak understanding on pre-requisite concepts and in visualising the steps of the mechanisms

Need complete understanding of previous topics e.g. identifying the functional groups and their characteristics, integrate them to solve reaction mechanism problems

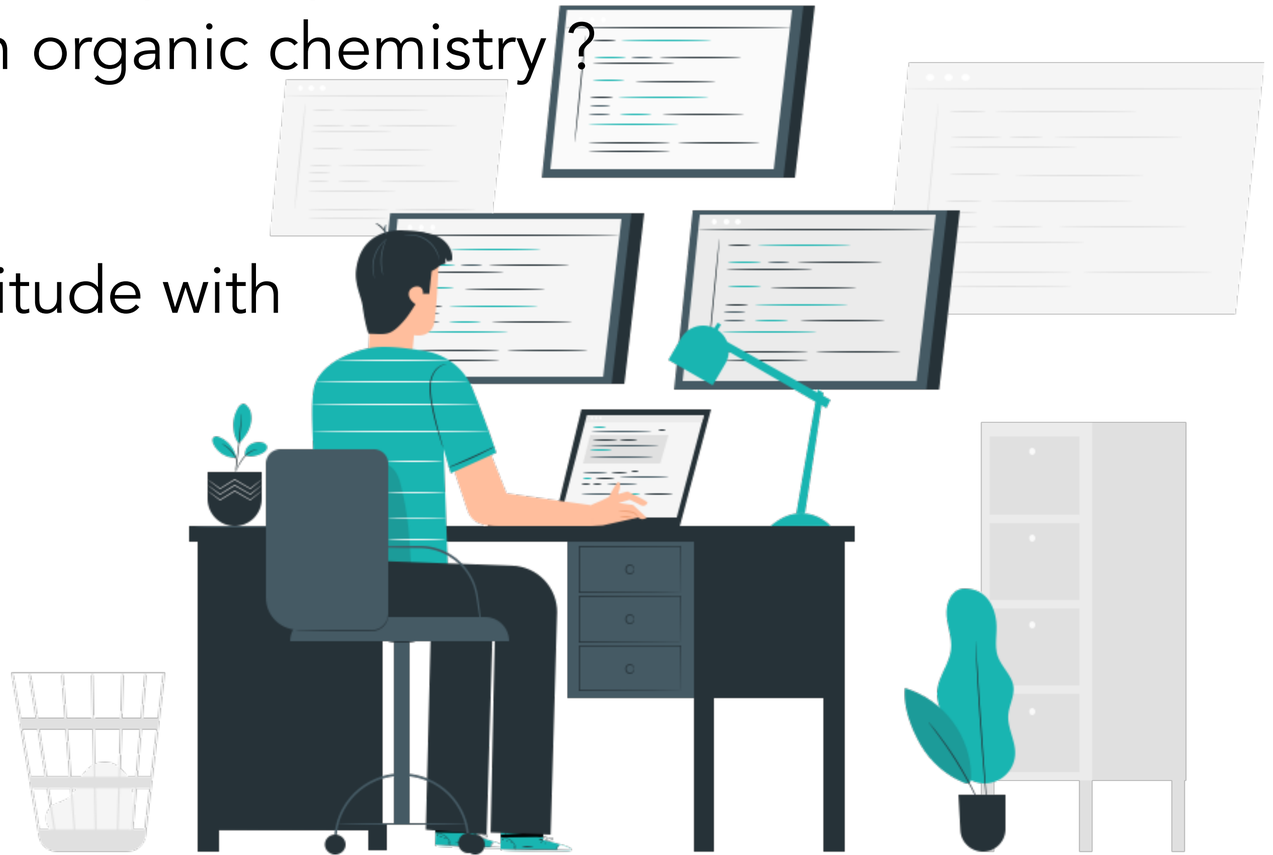
Dwyer, A. O., & Childs, P. E. (2017). Who says organic chemistry is difficult? Exploring perspectives and perceptions. Journal of Mathematics Science and Technology Education, 8223(7), 3599–3620

UG chemistry students difficulties in organic chemistry

Areas of organic chemistry that these students found difficult ?

Students' study attitude/perception on this subject affect their achievement in organic chemistry ?

Relation of study attitude with grades obtained?



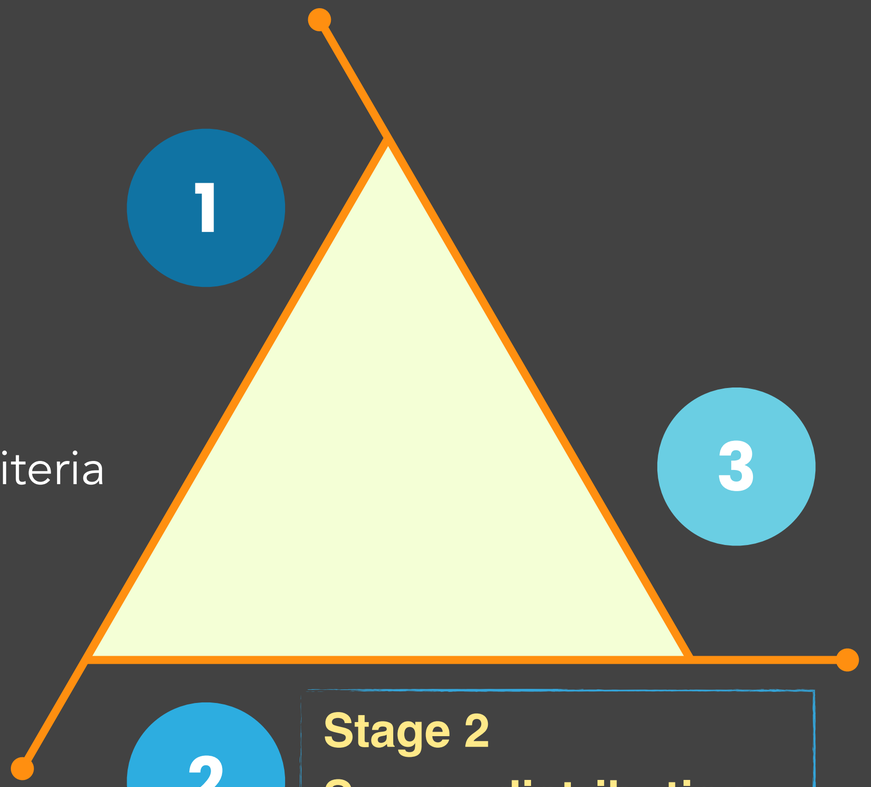
METHODOLOGY

Initial stage

Perceived difficulties on the areas of organic chemistry subject

Area Study
Population Study
Design Study
Sampling method

- Exclusion & Inclusion criteria
- Sample size calculation



Stage 2

Survey distribution

Perceived difficulties vs. grades obtained for Organic Chemistry (I and II)

Validation of questionaires
Research tools
Ethical consideration
Sampling method
Data collection

Final stage

Study attitude with the grades obtained for Organic Chemistry I and II

Statistical Analysis
Attitudinal Scale Analysis

Mean Score	Attitude
1.00-1.79	Highly unfavourable
1.80-2.59	Unfavourable
2.60-3.39	Undecided
3.40-4.19	Favourable
4.20-5.00	Highly Favourable

Research Design and Data Collection

Non- analytical & analytical study of cross-sectional

Convenience sampling method

Data collected through offline and online methods.

Statistical Analysis

1. descriptive analysis - percentage of answers from respondents based on their batch number. Compare data with the major answers of each batch of respondents.
2. The second analysis focused on answering the research questions —> Use Likert scale to measure respondents' opinions

Attitudinal Scale Analysis

1. Total score of each respondent was calculated.
2. Individual's mean score calculated
3. The types of study attitude grouped into five categories

RESPONDENTS

Second, third and fourth year students on undergraduate level of Department of Chemistry

193 undergraduate students from Department of Chemistry, International Islamic University Malaysia,

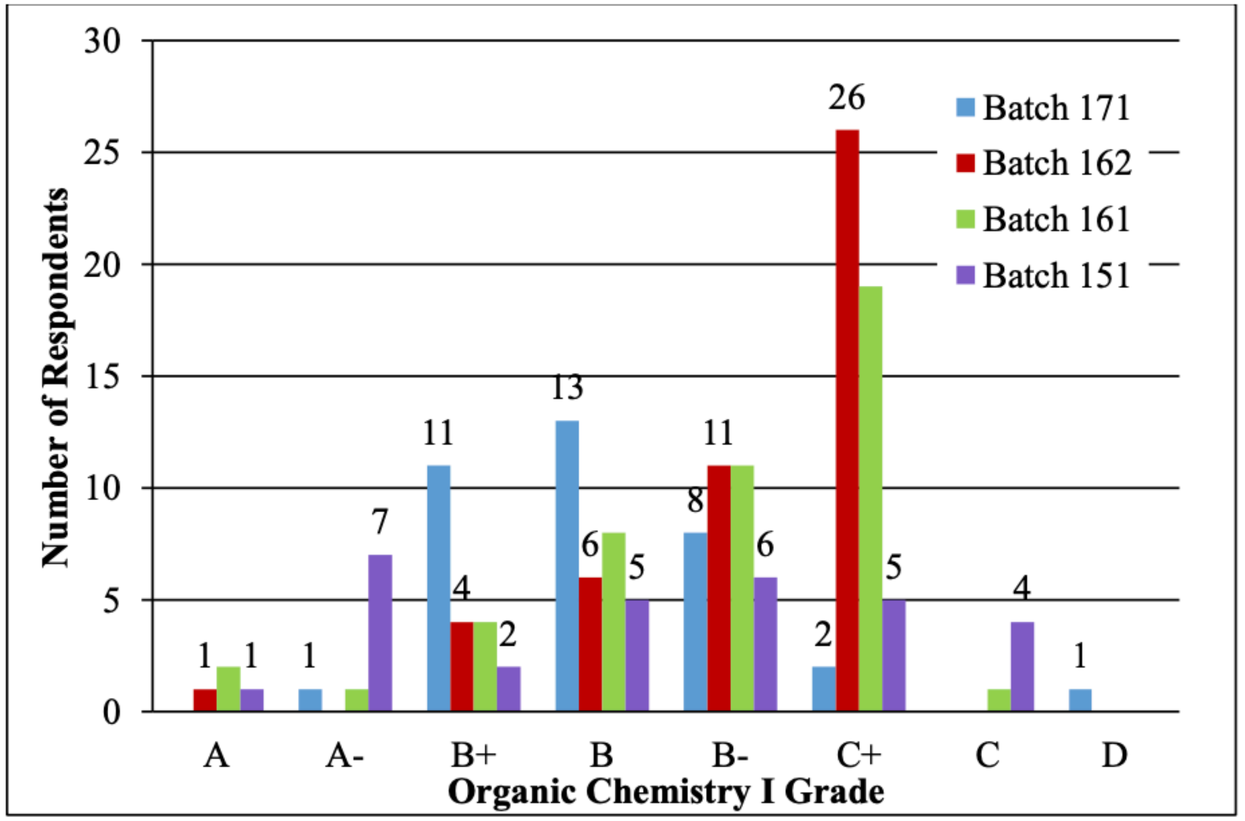
160 students of Year 2 until Year 4 took part in this study

Abd Hamid et al. (2021). IIUM Journal of Educational Studies, 9(2), 6-30.

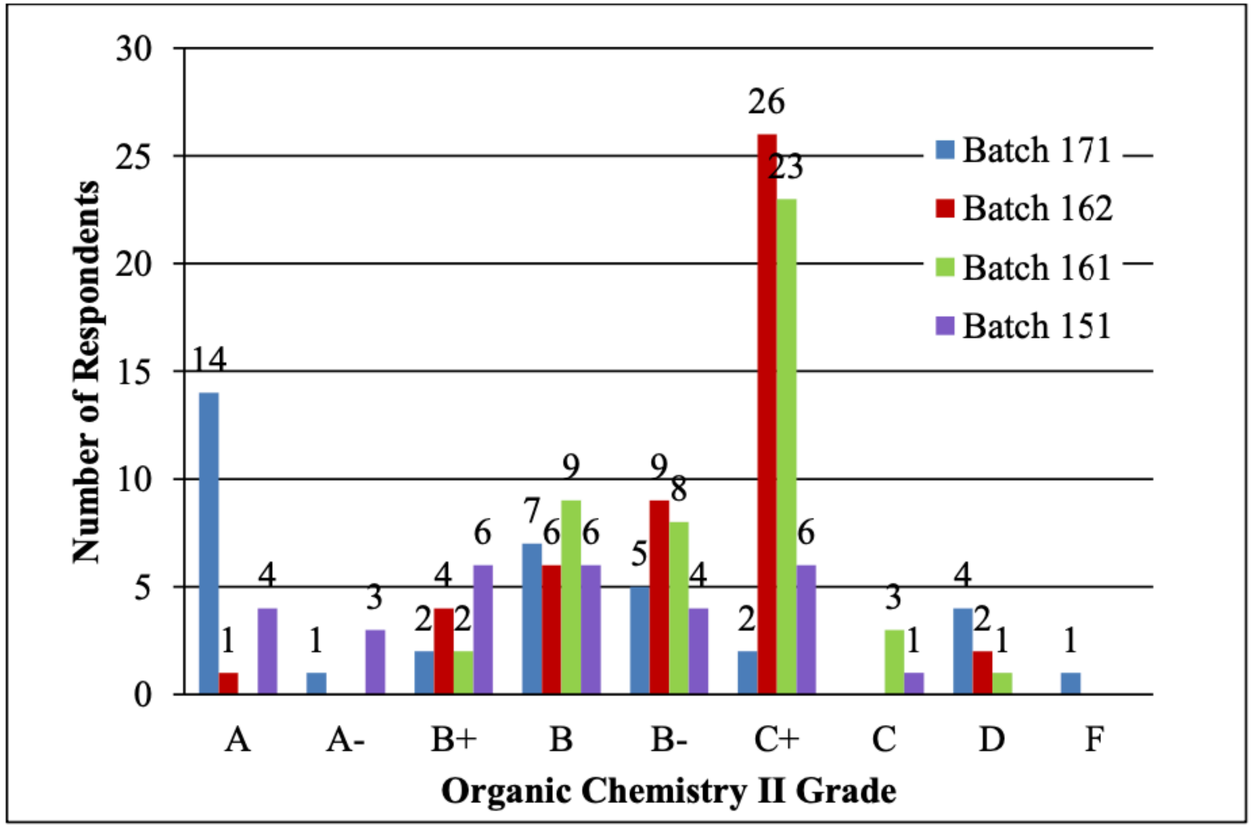
Tabulation of gender and batch among respondents (n = 160)

Batch Number, n (%)				
Gender	Batch 171	Batch 162	Batch 161	Batch 151
Male	10 (27.8)	16 (33.3)	8 (17.4)	6 (20.0)
Female	26 (72.2)	32 (66.7)	38 (82.6)	24 (80.0)
Total	36 (100)	48 (100)	46 (100)	30 (100)

Distribution of Organic Chemistry I Grade among Batches (n = 160)



Distribution of Organic Chemistry II Grade among Batches (n = 160)



SUBJECT	Level of Difficulty n (%)				
	Very Easy	Easy	Neutral	Difficult	Very Difficult
Analytical Chemistry	16 (10.0)	54 (33.8)	73 (45.6)	15 (9.4)	2 (1.3)
Organic Chemistry	2 (1.3)	3 (1.9)	23 (14.4)	54 (33.8)	78 (48.8)
Inorganic Chemistry	4 (2.5)	17 (10.6)	69 (43.1)	48 (30.0)	22 (13.8)
Biochemistry	2 (1.3)	10 (6.3)	78 (48.8)	49 (30.6)	21 (13.1)
Physical Chemistry	36 (22.5)	72 (45.0)	43 (26.9)	6 (3.8)	3 (1.9)

PERCEIVED DIFFICULTIES ON THE AREAS OF ORGANIC CHEMISTRY SUBJECT

EASY

Nomenclature (43.1 %)

NEUTRAL

Drawing of compound (42.5%)
Aromaticity (52.5 %)
Reaction type (52.5 %)

DIFFICULT

Stereochemistry (46.3 %)
Organic Reaction (46.9%)

VERY DIFFICULT

Reaction Mechanism (41.3 %)

Respondents' Study Attitude towards Organic Chemistry

Responses of Respondents to the Scale Items (n = 160)

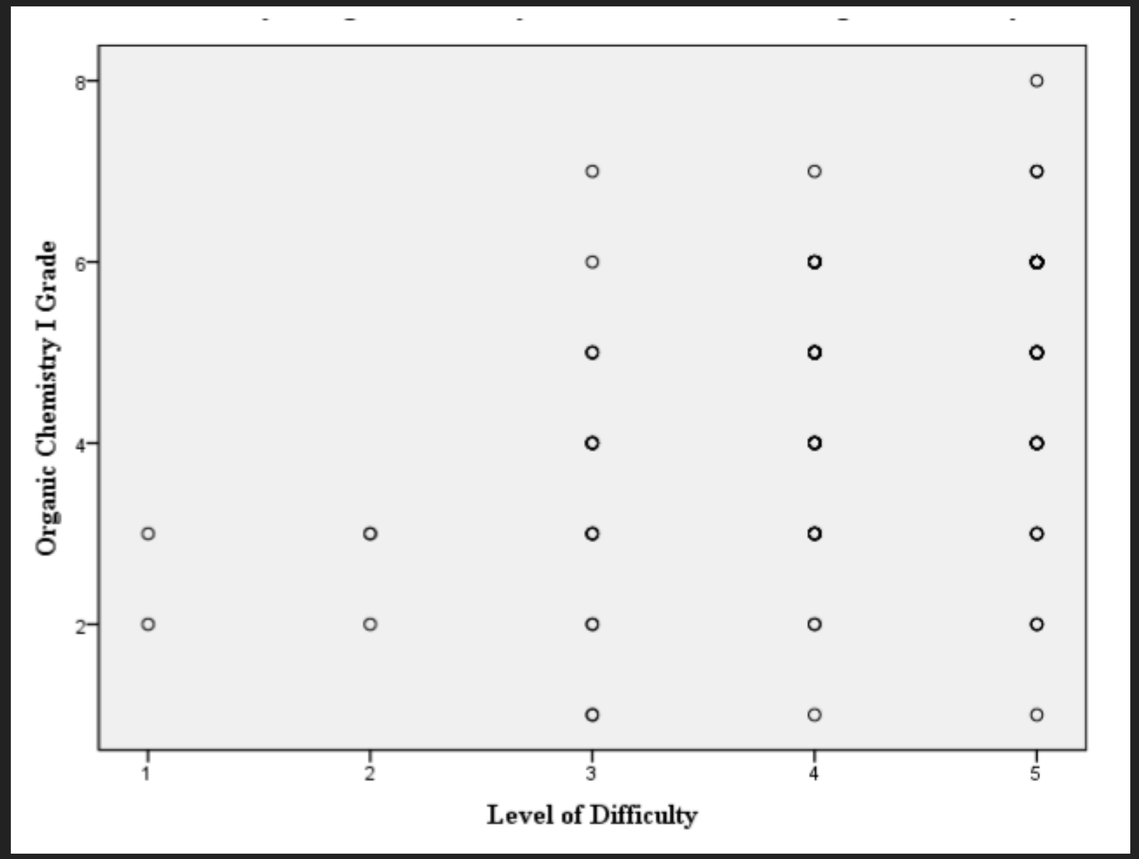
Simplified Statements	Likert Scale for Frequency, n (%)				
	Never (1)	Rarely (2)	Sometimes (3)	Very Often (4)	Always (5)
Effort:					
Organic Chemistry I	1 (0.6)	13 (8.1)	78 (48.8)	51 (31.9)	17 (10.6)
Organic Chemistry II	1 (0.6)	9 (5.6)	64 (40.0)	60 (37.5)	26 (16.3)
Persistence	1 (0.6)	10 (6.3)	56 (35.0)	63 (39.4)	30 (18.8)
Pre-class:					
Preparedness	35 (21.9)	67 (41.9)	47 (29.4)	9 (5.6)	2 (1.3)
Planned study time	11 (6.9)	28 (17.5)	78 (48.8)	30 (18.8)	13 (8.1)
Study as planned	18 (11.3)	34 (21.3)	89 (55.6)	17 (10.6)	2 (1.3)
Participation in class activity	8 (5.0)	60 (37.5)	57 (35.6)	24 (15.0)	11 (6.9)
Reference:					
Lecturer	32 (20.0)	66 (41.3)	37 (23.1)	12 (7.5)	13 (8.1)
Internet	2 (1.3)	10 (6.3)	30 (18.8)	64 (40.0)	54 (33.8)
Study method:					
Self-study	8 (5.0)	10 (6.3)	52 (32.5)	59 (36.9)	31 (19.4)
Memorisation of facts	5 (3.1)	11 (6.9)	44 (27.5)	71 (44.4)	29 (18.1)
Solve problem by self	2 (1.3)	7 (4.4)	52 (32.5)	68 (42.5)	31 (19.4)
Group-study	9 (5.6)	34 (21.3)	71 (44.4)	32 (20.0)	14 (8.8)
Post-class:					
Revision	1 (0.6)	9 (5.6)	48 (30.0)	59 (36.9)	43 (26.9)
Re-attempt problem	4 (2.5)	15 (9.4)	60 (37.5)	50 (31.3)	31 (19.4)
Submit assignments on time	2 (1.3)	1 (0.6)	11 (6.9)	44 (27.5)	102 (63.8)
Set target marks for:					
Examination	9 (5.6)	18 (11.3)	34 (21.3)	61 (38.1)	38 (23.8)
Assignments	11 (6.9)	30 (18.8)	54 (33.8)	40 (25.0)	25 (15.6)
Determined to reach target	2 (1.3)	12 (7.5)	56 (35.0)	64 (40.0)	26 (16.3)
Interest in study	6 (3.8)	10 (6.3)	71 (44.4)	46 (28.8)	27 (16.9)

Respondents' Study Attitude towards Organic Chemistry

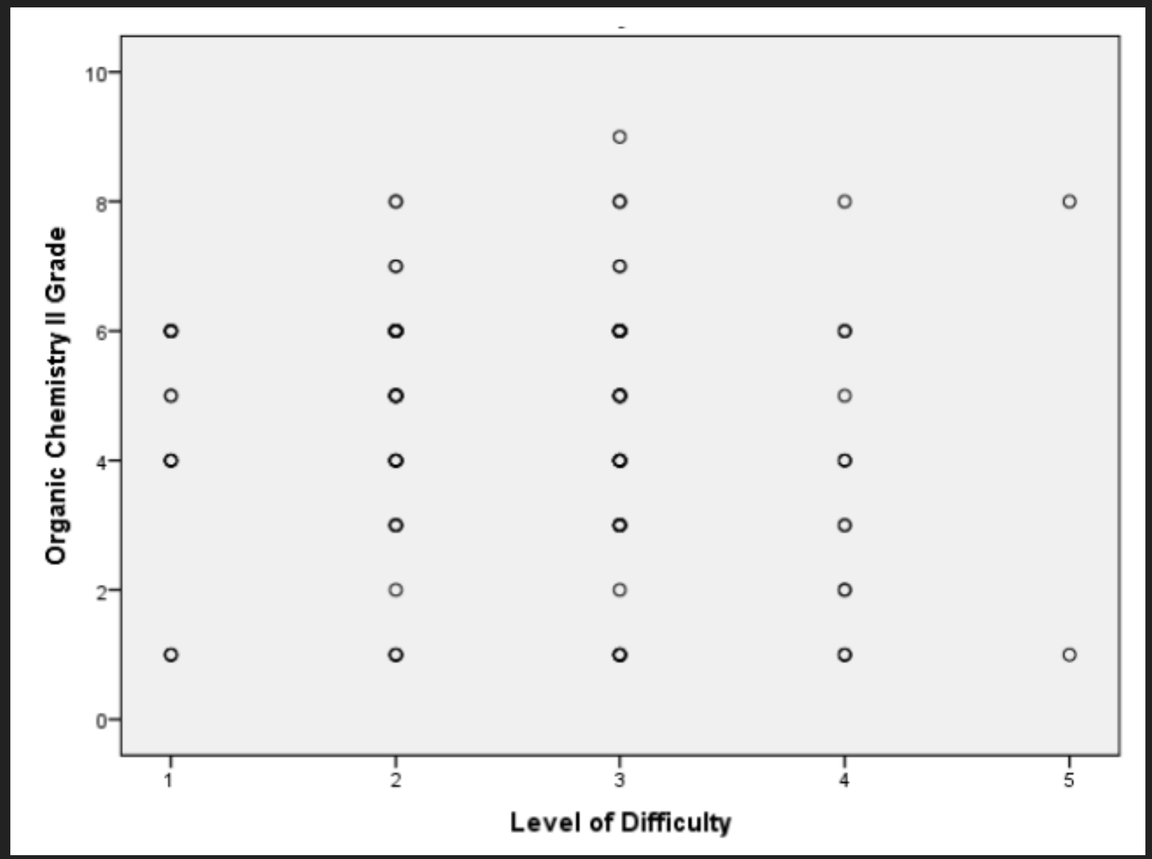
Continued

Simplified Statements	Likert Scale for Frequency, n (%)				
	Never (1)	Rarely (2)	Sometimes (3)	Very Often (4)	Always (5)
Relation with theory:					
Laboratory session	3 (1.9)	38 (23.8)	48 (30.0)	48 (30.0)	23 (14.4)
Projects	1 (0.6)	7 (4.4)	31 (19.4)	67 (41.9)	54 (33.8)
Marks of these are important:					
Laboratory reports	1 (0.6)	1 (0.6)	23 (14.4)	66 (41.3)	69 (43.1)
Projects	1 (0.6)	3 (1.9)	17 (10.6)	52 (32.5)	87 (54.4)

CORRELATION



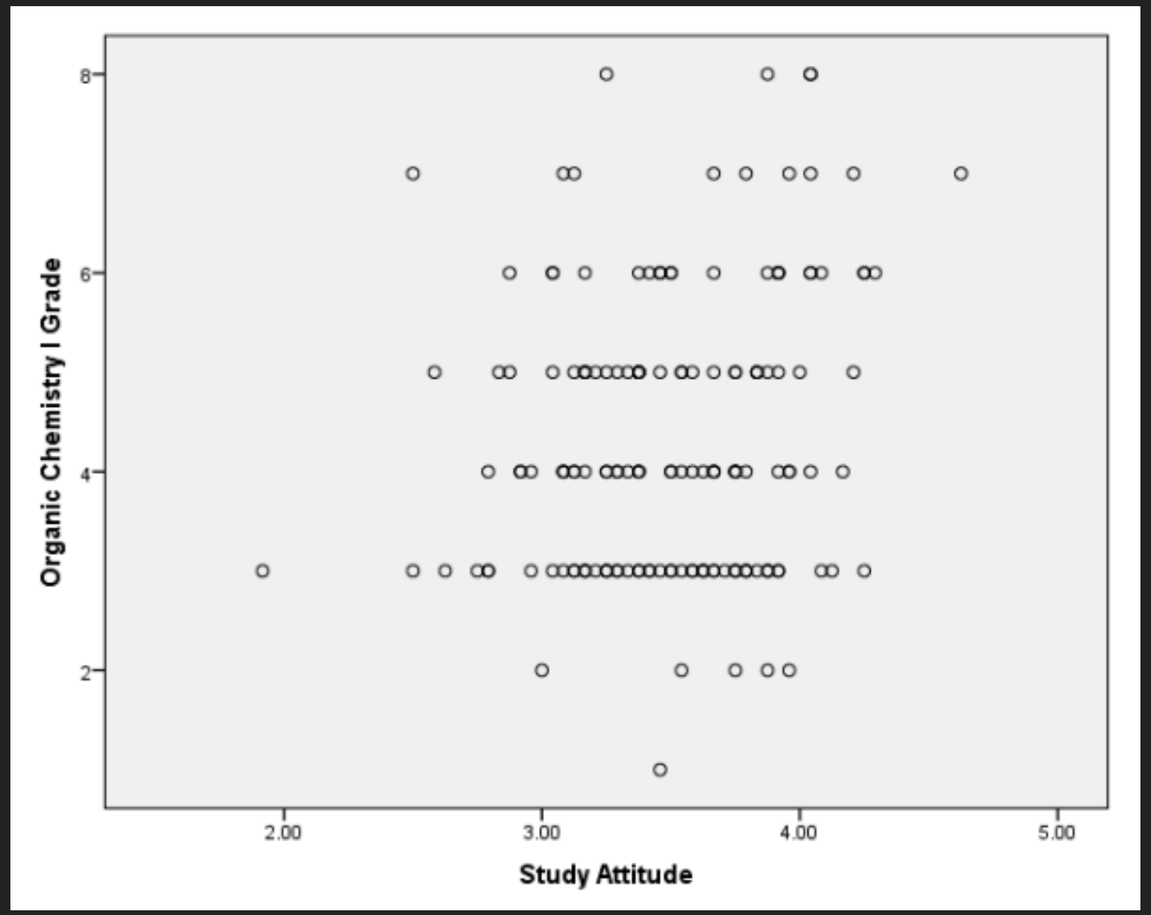
Level of difficulty vs Organic Chemistry I grade



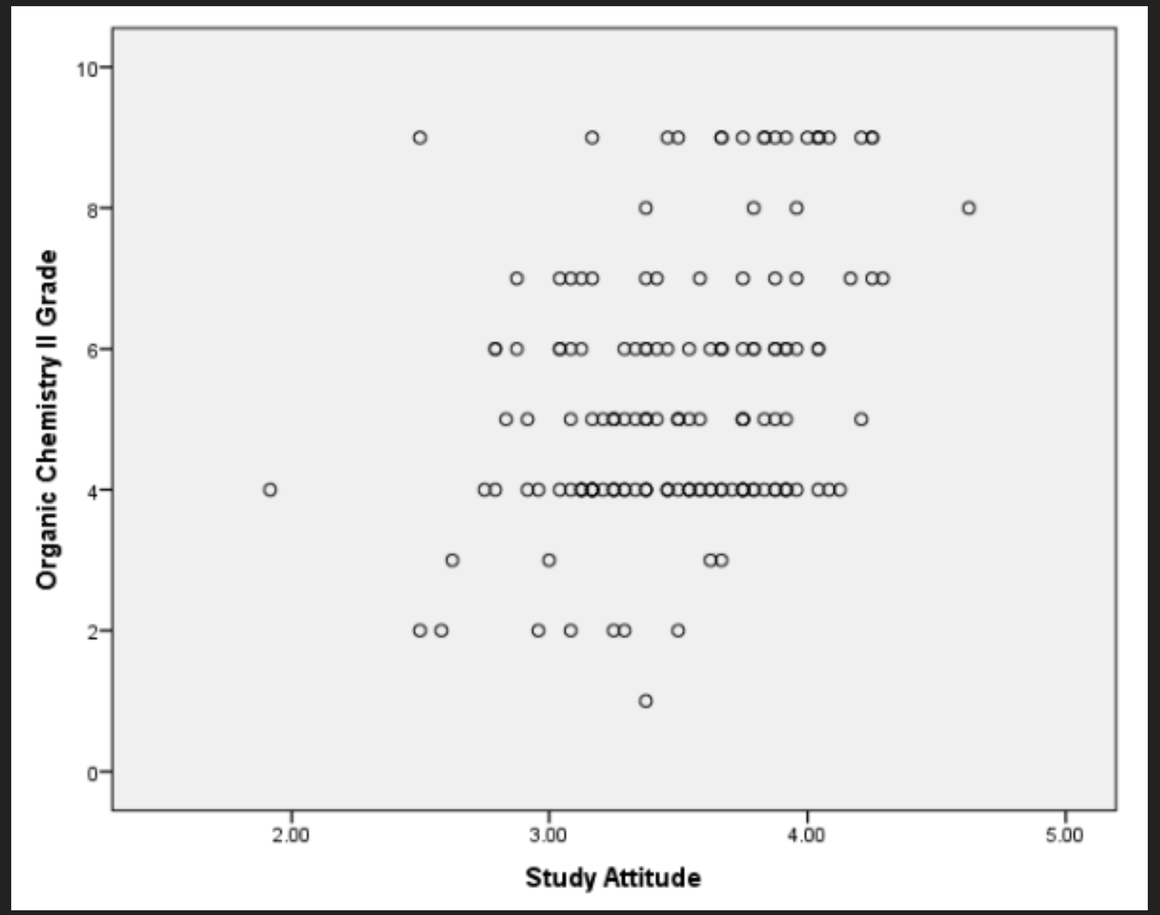
Level of difficulty vs Organic Chemistry II grade

Level of Difficulty	Correlation Coefficient, r	P-value
vs Organic Chemistry I grade	0.413^{**}	$p<0.01$
vs Organic Chemistry II grade	0.436^{**}	$p<0.01$

- Significant positive association were proved by the *p*-value
- High value of *r* denoted the strong association between the variables.



Study attitude vs Organic Chemistry I grade



Study attitude vs Organic Chemistry II grade

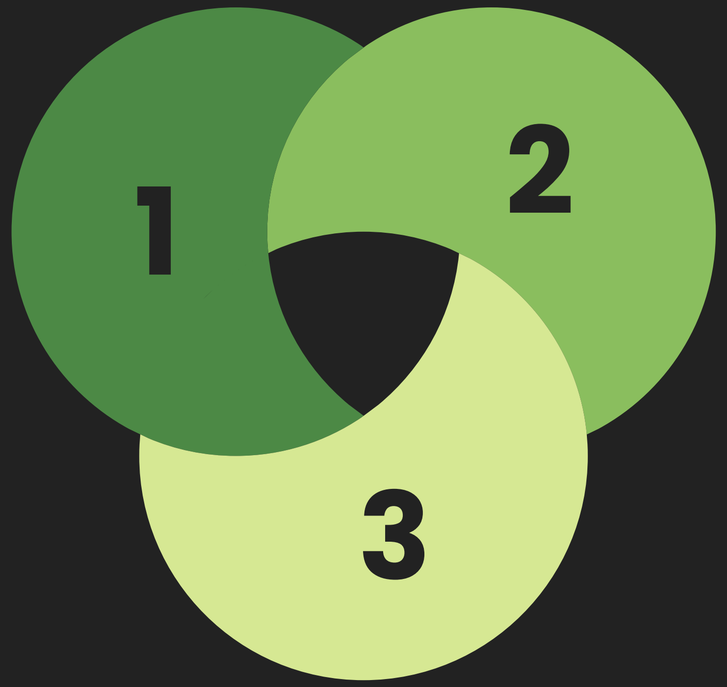
Study Attitude	Correlation Coefficient, r	*p*-value	Statement
vs Organic Chemistry I grade	0.140 (very weak correlation)	p=1.00 (not significant)	No correlation
vs Organic Chemistry II grade	0.330^{**} (weak correlation)	p<0.01 (significant)	Significant weak correlation

CONCLUSION

GENERAL OVERVIEW

Insights of the difficulties faced by the students so that preventive solutions can be outlined and carried out for the betterment of the students' academic achievement in the future

The result of this study revealed that the quality of the study attitude of the students throughout their organic chemistry study does not affect the grade obtained for Organic Chemistry I subject. However, better quality of study attitude gave better grade in Organic Chemistry II.



WHAT WE CAN DO?

Conducting group activities such as problem solving, tutorials or worksheets require the engagement of each of the students at the end of each of the class session.

To make it more interesting, the design of the class should be modified to increase students' engagement during the conduct of the class.

WHAT'S NEXT?

Further study can be conducted to identify external factors such as the environment of the classroom or interest to learn

Analysis of the students' answers and scores through the implementation of the quizzes on each of the topics in organic chemistry study will also give more detailed view on their understanding of that area.

ACKNOWLEDGEMENTS

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Assoc. Prof. Dr Nor Azlina A. Rahman

Chemistry students, Department of Chemistry

Kulliyyah of Science , IIUM

THANKS

International Seminar on Chemical Education ISCE

Himpunan Kimia Indonesia

CERTIFICATE

No: 015a/STK-JURKIM/FMIPA/IX/2021

This certificate is awarded to

Prof. Dr. Shafida Abdul Hamid

as

Invited Speaker

4th International Seminar on Chemical Education

with the theme: "Chemistry Resilience & Continuity in the Covid-19 Pandemic"

co-organized by:

Department of Chemistry, Faculty of Mathematics & Natural Sciences, Universitas Islam Indonesia (UII)

Department of Chemistry, Kulliyyah of Science (KOS), International Islamic University Malaysia (IIUM)

September 15, 2021, Indonesia

Prof. Riyanto, Ph.D.
Dean of Faculty of Mathematics & Natural Sciences

Prof. Dr. Is Fatimah, M.Si.
Organizing Chairperson of The 4th ISCE

UNIVERSITAS
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Program Book

4th International Seminar on Chemical Education

ISCE

Program Book

ISCE

4th International Seminar on Chemical Education

"Chemistry Resilience and Continuity in the Covid-19 Pandemic"

September 15, 2021, Indonesia

UNIVERSITAS ISLAM INDONESIA

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

Preface

International Seminar on Chemical Education 2021 (ISCE 2021) is conducted by Department of Chemistry, Faculty of Mathematics and Natural Science, Islamic Universitas Islam Indonesia, Yogyakarta at September 15th, 2021. The seminar under the theme "Chemistry Resilience and Continuity in the Covid-19 Pandemic".

The aim of the seminar is to explore and develop the concept of learning, innovation and competence building as a chemistry education framework. The objective of ISCE is to stimulate the establishment of knowledge based strategies or teaching development in Senior High School and College. The idea of the seminar is to bring together interesting issues about what is going on ASEAN countries, School, university and to share experience regarding methodology of design thinking in teaching area.

Topic of interest to be covered in the conference includes, but not limited to:

1. Chemistry education curriculum and policy
2. Teacher learning and education (in-service and pre-service teachers)
3. Environmental and social issues in chemistry
4. Assessment and evaluation
5. Independence learning and digital learning
6. Skill oriented and instructional learning in 21st century
7. Classroom action research in sciences
8. Environmental chemistry and its aspects
9. Renewable and sustainable energy
10. Materials and advance materials
11. Green chemistry, chemical engineering and chemical process

This program and abstracts book provides some information concerning the schedule, list of presenter and poster presenter. Hopefully, this book helps the participants for intensively listen and get valuable information in the conference.

The scientific program of ISCE 2021 comprises the following:

Keynote speakers	6 papers
Invited speakers	5 papers
Total papers for oral presentation	56 papers
Total papers for poster presentation	25 papers
Total papers	**92 papers**

Time Schedule
The 4th International Seminar on Chemical Education (ISCE) 2021
Wednesday, September 15th, 2021

Time	Activity	PIC	Media
08.00-08.30	Registration	Committees	
08.30-08.40	Opening Ceremony Recitation of Holy Qur'an National Anthem of Indonesia Hymn of Universitas Islam Indonesia	**Mila Minhatul Maula**, S.Pd.	Zoom
08.40-08.45	Welcoming Address by The Chair Person of ISCE	Prof. Dr. **Is Fatimah**, M.Si.	Zoom
08.45-08.50	Welcoming Address by The President of Indonesian Chemical Society	Dr. **Mohamad Rafi**	Zoom
08.50-08.55	Welcoming Address by The Campus Director of International Islamic University Malaysia, Kuantan	Prof. Dr. **Kamaruzzaman Yunus**	Zoom
08.55-09.10	Opening and Welcoming Address by The Rector of Universitas Islam Indonesia	Prof. **Fathul Wahid**, S.T., M.T., Ph.D.	Zoom
09.10-09.15	Photo Session	**Mila Minhatul Maula**, S.Pd.	Zoom
09.20-09.35	*Plenary Session 1* Prof. Dr. **Edy Cahyono**, M.Si. Universitas Negeri Semarang Indonesia *"Strengthening the Student's Representation Ability on Mastering the Concepts of Organic Reaction Mechanisms Through Project-Based Learning"*	Moderator Dr. **Nurasyikin Hamzah**	Zoom
09.35-09.50	Prof. Dr. **Supawan Tantayanon** Chulalongkorn University Thailand *"Online Teaching Hands-on Chemistry Experiments: Small Scale Chemistry"*		
09.50-10.05	**Pradeep Shukla**, Ph.D. University of Queensland Australia *"Changing dynamics of chemical manufacturing- Centralized plant v/s Distributed plants"*		
10.05-10.30	Discussion		
10.30-10.45	*Plenary Session 2* Prof. Dr. **Mustafa SÖzbilir** Ataturk University Turkey *"Teaching Chemistry during Covid-19 Lockdowns"*	Moderator **Imam Sahroni**, M.Sc.	Zoom
10.45-11.00	Prof. Dr. **Kamisah Osman** Universiti Kebangsaan Malaysia Malaysia *"From Higher Order Thinking to Computational Thinking Skills: Implication to Chemistry Teaching and Learning"*		
11.00-11.15	Prof. **Shin-Ichi Ohira**, Ph.D (Sci) Kumamoto University Japan		

	"Electrodialytic ion handling for chromium speciation analysis"		
11.15-11.45	Discussion		
11.45-12.00	Closing	**Mila Minhatul Maula**, S.Pd.	Zoom
12.00-13.00	Break Poster Slide Show	Committees	Zoom
13.00-14.30	*Invited Speaker Session* **Gani Purwiandono**, Ph.D. Universitas Islam Indonesia *"Synthesis of Cubic-Shape La2Ti1-xVxO7 Nanocrystal and Its Photoelectrochemical Property"*	Moderator Dr. **Nurul Iman Aminudin**	Zoom Room Breakout
	Salmah Aminati, Ph.D. Universitas Islam Indonesia *"Density Functional Study of Metal-to-Ligand Charge Transfer and Hole-Hopping in Ruthenium(II) Complexes with Alkyl-Substituted Bipyridine Ligands"*	Dr. **Maisari Utami**	
	Assoc. Prof. Dr. **Deny Susanti** International Islamic University Malaysia *"Marine Algae: Chemistry and Potential"*	**Mai Anugrahwati**, M.Sc.	
	Dr. **Antuni Wiyarsi**, M.Si. Yogyakarta State University *"Extending Students' Analytical Thinking Ability in Acid Base Learning via Common Knowledge Construction Model"*	Dr. **Maryam Zahaba**	
	Prof. Dr. **Shafida Abdul Hamid** International Islamic University Malaysia *"Perception of Undergraduate Students in Learning Organic Chemistry at Kulliyyah of Science (IIUM): A Preliminary Study"*	Dr. **Saiful 'Arifin Syafiee**	
13.00-14.30	Oral Presentation Session	Oral presenters	Zoom Breakout
13.00-14.30	Poster Presentation Session	Poster presenters	Google Classroom
14.30-14.35	All participants return into Zoom main room	Committees	Zoom
14.35-15.00	Closing Awarding for best poster and best presenter	**Mila Minhatul Maula**, S.Pd.	Zoom

Content