Department of Aerospace Engineering Online Bulletin

3rd Quarter, 2022

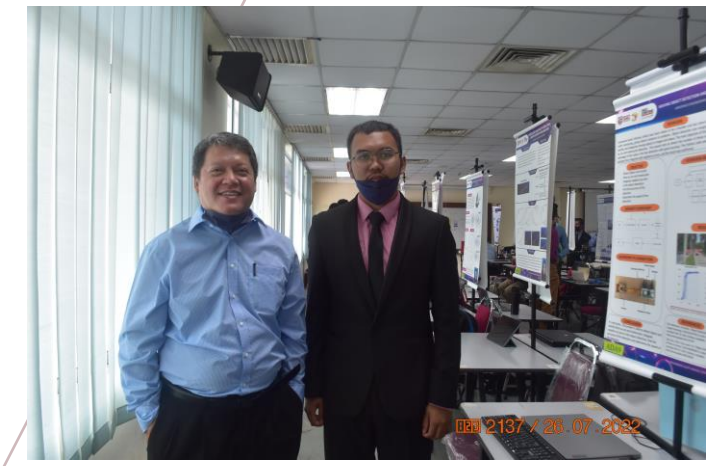
Content

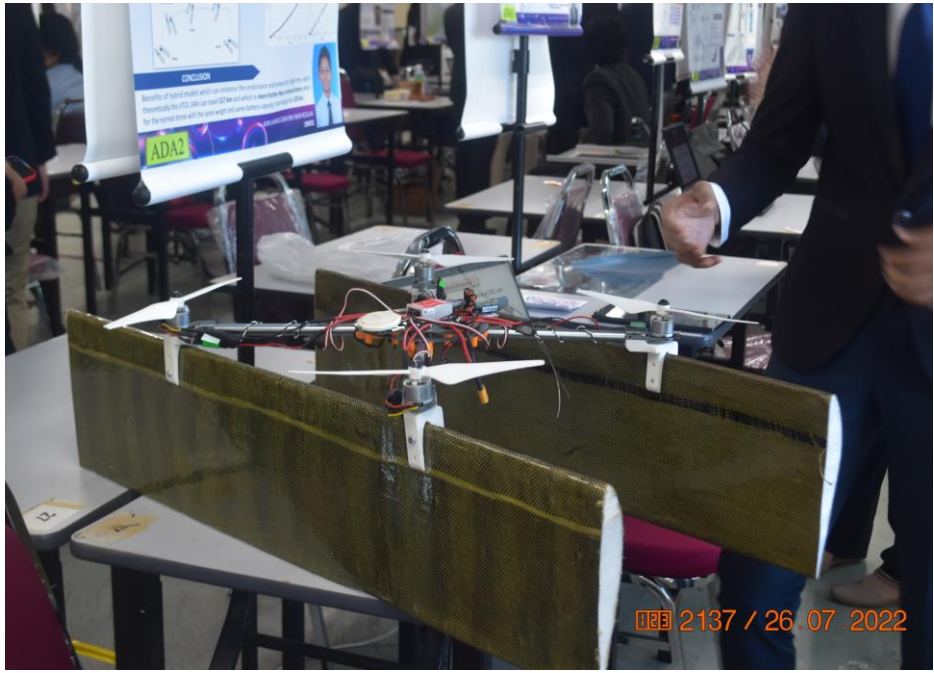
UNIVERSITI PUTRA MALAYSIA
BERILMU BERBAKTI

FINAL YEAR PROJECT EXHIBITION DAY 2022

FACULTY OF ENGINEERING, UPM

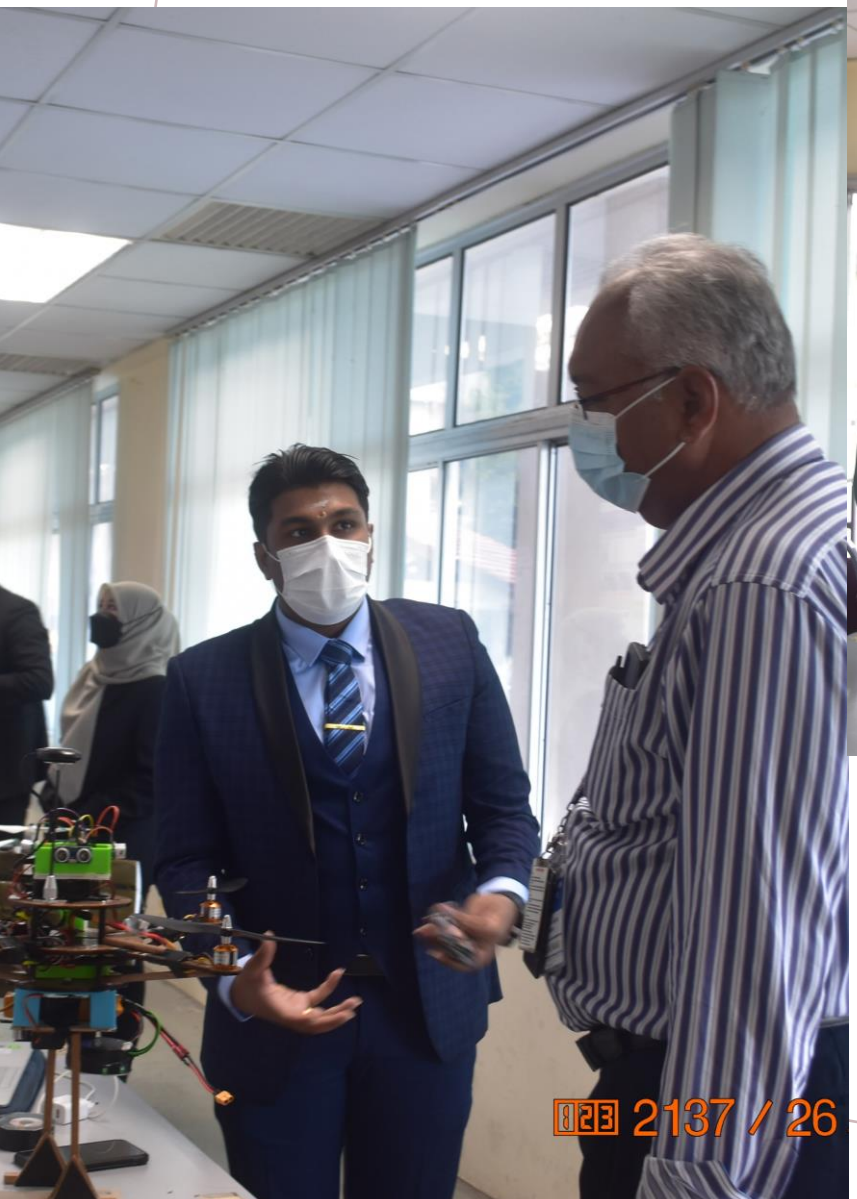
On 26 & 27 July 2022, Faculty of Engineering, University Putra Malaysia organized the Final Year Project Exhibition Day. It is an annual event for the undergraduate final year students. On this day, the final year students have to present their final year project and they will be evaluated by internal (UPM) and external (Industry) panelists.





- The students also have to present their prototype, or research product based on their final year project.
- The external panelists are experienced individuals. They observe and assess projects that have possibilities to be implemented and can contribute to renown industrial partners.
- MAB, STRIDE, AMIC, and FAAS Engineering are among the invited Aerospace Companies assigned as panelists for the exhibition.

Dr. Umran from MAHB evaluating a project on biplane rotary UAV presented by Yavin, a student.



Mejar. Ir. Hj Abdul Kadir is also one of the external panelists.

En. Ismail Sulaiman is very happy with the student presentations during the exhibition day.

TAHUN AKHIR

Aerospace Engineeri

Medal
GOLD

DISCIPLINE: AEROSPACE DESIGN AND APPLICATIONS

NAME	MAT... NO	P... CT TITLE	SUPERVISO
KNESWARAN A/L DEVANDRAN		ACTIVITY FOR AI...	ASSOC. PROF. FAIRUZ IZZUD ROMLI

Medal
GOLD

DISCIPLINE: STRUCTURES AND MATERIALS

NAME	M...RIC	PROJECT TITLE
PREVINDRAN A... NDA RAJOO		DEV... ST... INSPECTION DRONE: ...LYSIS OF FRAME KIT ...NATURAL FIBRE

AMONG THE WINNERS OF FYP EXHIBITION DAY 2022

Medal
GOLD

DISCIPLINE: AEROSPACE DYNAMICS AND CONTROL

NAME	MA... NO	PROJECT TITLE	SUPERVI...
NURUL ALEESY... HILMAN SY...		IN... ...TION OF AERODYNAMIC AND ...ERFORMANCE WING-IN-EFFECT (WIG) CRAFT	DR. MD. AN... MD. ZHA...

Medal
GOLD

DISCIPLINE: AERODYNAMICS AND PROPULSION

NAME	MA... NO	PROJECT TITLE
DANIA IRDIN... ...AL BINTI		DEV... W... U... ...ENT OF AEROENGINE FIRE ...TANDARD FIRE TESTING ...RAL FIBRE COMPOSITE

Editor:

Izzat Najmi Bin Mohd Yaacob
Department of Aerospace Engineering
Faculty of Engineering
University Putra Malaysia

PROGRAM SEMARAK MERDEKA UNIVERSITI PUTRA MALAYSIA 2022 PERINGKAT FAKULTI KEJURUTERAAN

30 OGOS 2022

JABTAN KEJURUTERAAN AEROANGKASA FAKULTI KEJURUTERAAN, UNIVERSITI PUTRA MALAYSIA

- Pada 30 Ogos 2022, Fakulti Kejuruteraan Universiti Putra Malaysia telah mengadakan Pertandingan Kibar Jalur Gemilang bersempena Program Semarak Merdeka 2022 UPM.
- Pertandingan ini dilangsungkan di sekitar Fakulti Kejuruteraan dan setiap jabatan termasuk Jabatan Kejuruteraan Aeroangkasa mengambil bahagian dalam pertandingan ini.

Tahniah

RM 300

Jabatan Kejuruteraan Aeroangkasa

JOHAN

Program Semarak Merdeka 2022 Peringkat Fakulti Kejuruteraan

Hadiah Akan Disampaikan Semasa Program Inovasi Dan Apresiasi (Pia), Fakulti Kejuruteraan

- JABATAN AEROANGKASA DIANUGERAHKAN PINGAT EMAS DALAM PERTANDINGAN HIASAN BERSEMPENA PROGRAM SEMARAK MERDEKA 2022 PERINGKAT FAKULTI KEJURUTERAAN

- ANTARA STAF-STAF JABATAN KEJURUTERAAN AEROANGKASA UPM YANG TERLIBAT

Kemerdekaan

- FAKULTI KEJURUTERAAN KERANA TELAH MENDAPAT DIPILIH SEBAGAI PEMENANG DALAM 10 TERBAIK DAN MENDAPAT ANUGERAH PERDANA JALUR GEMILANG SEMPENA PROGRAM SEMARAK MERDEKA 2022
- FAKULITI KEJURUTERAAN JUGA MENDAPAT ANUGERAH KHAS KATEGORI “KOMITMEN PENGURUSAN PTJ’

Editor:

Izzat Najmi Bin Mohd Yaacob
Department of Aerospace Engineering
Faculty of Engineering
University Putra Malaysia

ARTICLE OF THE MONTH

SEPTEMBER 2022

DR. MOHD FIRDAUS BIN ABAS

“INSPIRED BY NATURE - BIOMIMETICS”

Inspired By Nature - Biomimetics

Dr. Mohd Firdaus Bin Abas

Modern marvels. As human beings, we are blessed by Allah with the ability to understand, apply, and reinvent technical ingenuity into gigantic proportions with the advancement in current technology. But don't be confused, modern marvels don't always come in the form of enormous infrastructures. They also come in small sizes as well and sometimes, smaller than you think!

No scientific terms or technology for that matter, explains "Inspired By Nature" better than Biomimetics. And nothing speaks out "minute" louder than Micro-Aerial-Vehicles (MAV). Though a smaller aerial vehicle termed Nano-Aerial-Vehicle (NAV) already exists, let's save the discussion on NAV for later issues and build our fundamental knowledge around MAVs.

As much as we would like to take all the credits, nature has been our most prominent source of

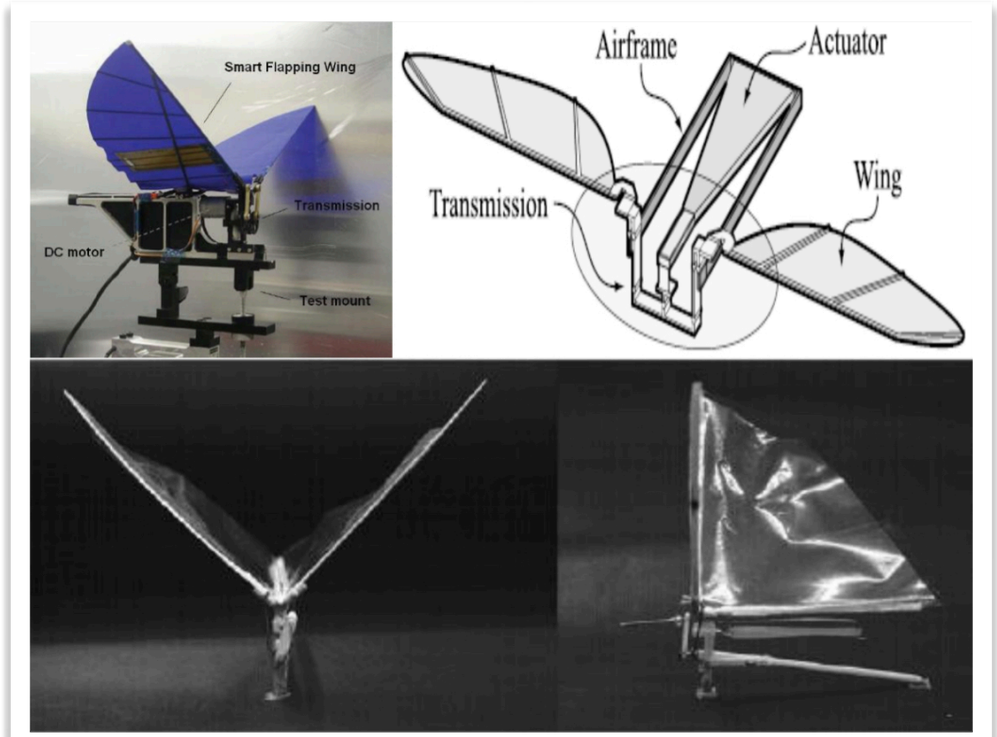


Fig. 1 Various Types of Bio-Mimicry; Generic Bird (Top-Left)[1], Fruit Fly (Top-Right)[2], and Butterfly (Bottom)[3].

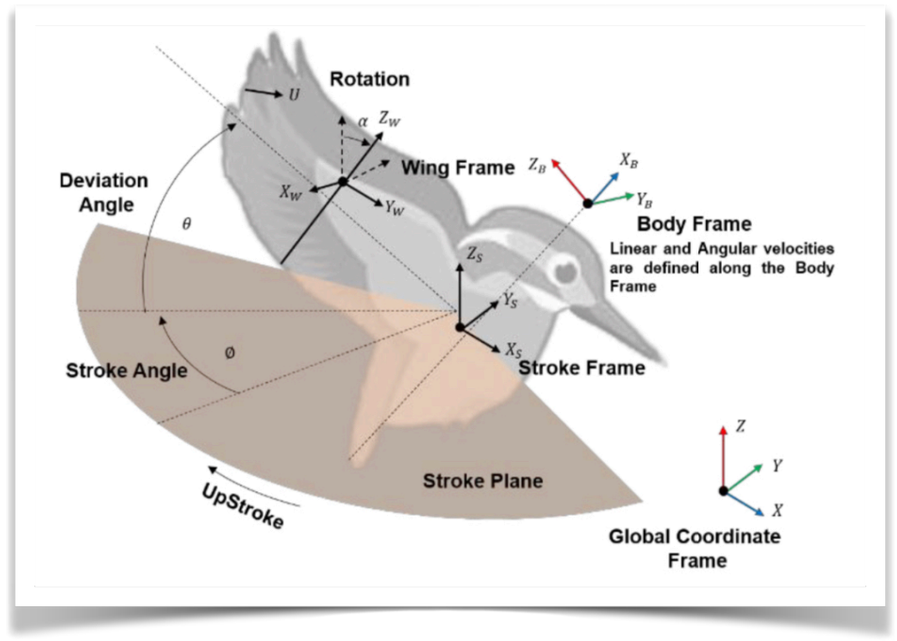


Fig. 2 Flying Sequence of A Dwarf Kingfisher.

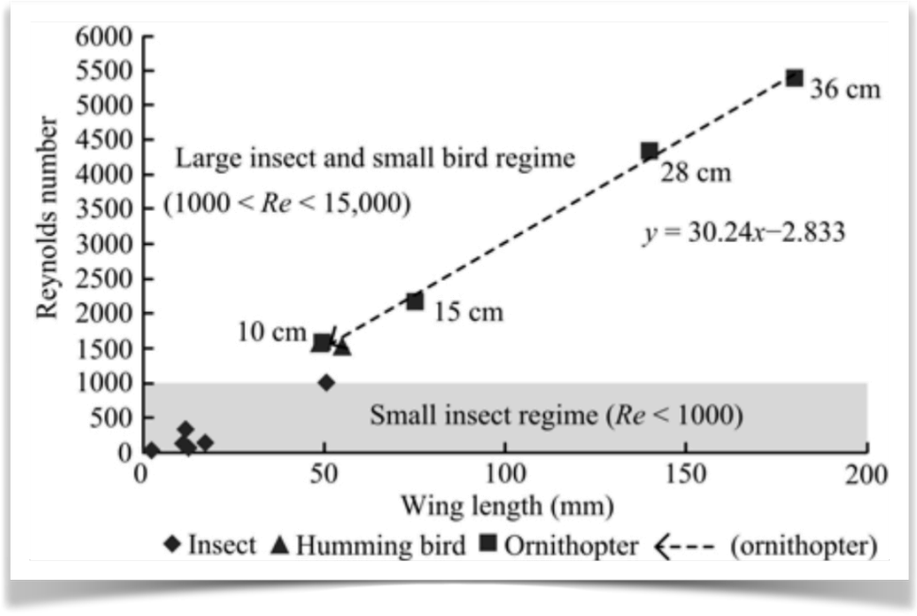


Fig. 3 Reynolds Number Versus Wing Length[4].

reference and ever so often, she gave us hints on how to build effective and efficient man-made technologies if we ever seek for it.

By DARPA's definition, a MAV should have a size limitation of 15 cm or less for its tip-to-tip span wise length and resides under the 15,000 Reynolds Number benchmark. To keep afloat during flight, a MAV, aligned with its bio-mimicry reference, needs to produce sufficient lift and thrust through unconventional, self-generated means, commonly known as wing flapping.

A pair of wings can have up to 3 degree-of-freedoms, which enables a particular bird to fly freely in almost all directions on a given axis. Similar to a rotary propeller, a wing "rotates" between its down-stroke and up-stroke flapping motions to generate enough force to balance the entire bird body along its flight trajectory or even during hover, with the assistance of a tail.

Generally, flapping patterns are divided into 2 types; ornithopters and insects. The ornithopter type flapping pattern refers to the typical flapping pattern of a bird, which consist of specific angular motions about the stroke, deviation, and pitching/ feathering angles, limited only by its own

anatomical capabilities.

As for the latter, the insect type flapping pattern forms the figure-of-8 motion, having full control of the wing's individual pitching/twisting motion to manoeuvre the entire insect body in midair effectively and efficiently. Though in general, ornithopter type flapping pattern exclusively refers to a bird's flapping wing motion as insect type to insect's, there are a few exceptions thrown into the mixup. Nothing can be more obvious than the renowned Hummingbird.

It is undeniably interesting to dive into research on Hummingbirds, but there are limited research done and even less made available regarding a range of birds that dwells on the borderline Reynolds number between small birds and large insects that still retains as ornithopter flyers. There are so much untapped knowledge yet to be discovered and learned from these selected avians, which begs the question:

"Why Do They Exist?"

References

[1] Chang K, Rue J, Ifju P, Haftka R, Schmitz T, Tyler C, Chaudhuri A, Ganguly V. Analysis of Thrust Production in Small Synthetic Flapping Wings. The Society for Experimental Mechanics, Inc. 2014.

[2] Orlowski CT, Girard AR. Modeling and simulation of nonlinear dynamics of flapping wing micro air vehicles. AIAA Journal 2011;49:969–81.

[3] Sun M, Xiong Y. Dynamic flight stability of a hovering bumblebee.J ExpBiol 2005;208:447-459.;doi:10.1242/jeb.01407.

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Verification OR Validation?

Researchers always use the terms (i.e. verification and validation) interchangeably. Some might use verification and others use validation for the purpose of convincing that the work proposed or performed is credible. But what is the difference between these two terms?

In computer-based method of analysis, the accuracy and reliability of the method is essential and thus the procedure of verification and validation is quite vital. Always the main objective of the development of computer-based method using related theories is to represent the true physical behaviour of the structure or system under consideration and this will become questionable if the method is not verified and validated. There is a phrase in computer modelling which says that “rubbish in rubbish out”. A few people can model the physical structure or system but how do we know that the modelling is good enough!

Verification is a process of attesting that the computer-based algorithm is consistent with the fundamental mathematical model and must be within a given degree of accuracy. There should not be any conceptual contradictions between the mathematical model of the problem and the associated programming. Some tests or procedures must be carried out to demonstrate good consistency in results obtained from the computer-based algorithm or simulation with the associated mathematical modelling. In finite element method, one way of verification is to conduct mesh convergence study, or some say mesh independence study. This is to show that the results obtained or output from the analysis is consistent and will not change with the number of elements used. This does not involve evaluation with results from other simulations or experimental works. For experimental work, verification is a process of proving that all the

measurement used in the test work give the right magnitude. For example, if the test requires distance, load, or frequency to be taken in the measurement, some procedures must be made in order to confirm that the data provided by the machine is correct.

Validation is a process of showing that the developed mathematical model gives good approximate to the true physical behaviour with a satisfactory accuracy. The results must have consistency with those obtained from the independent simulation, accepted theories, or experimental investigation.

It is the responsibility of the researchers to carry out appropriate verification and validation study to justify that the work has been performed according to good scientific practice.

Author:

Assoc. Prof. Dr. N. Yidris is a Senior Lecturer in the Department of Aerospace Engineering, Faculty of Engineering, Universiti Putra Malaysia. He is also the current Head of Department.

Atomic Teaching I: The Jigsaw Technique
"Little Change, Big Impact"

One of my biggest problems in applying student-centered learning is that not every student takes part in it. I would see only a handful of active students who would take charge of the discussion, write notes, and ask questions. The rest? Hands under their chins waiting for something to happen; or worse, twiddling with their phones waiting for time to pass. What I wanted was actually for these groups of students to work together, to learn and collaborate, and to teach each other what they've learned or discovered in my lecture. But it didn't happen.

That was until I experimented with the jigsaw technique. It is a simple technique involving separating the class into groups to work on small tasks and then mixing up the groups later to let the members report to each other of what they've learned in the previous. I found that, with this technique, students feel more responsible for their learning – because they need to teach their peers later! The process derives its name from the jigsaw puzzle because it involves putting the parts of the assignment together to form a whole picture. It was originally designed by social psychologist Elliot Aronson to help weaken racial cliques in forcibly integrated schools.

Here's a practical little example you can use to start with this technique:

1. A lecture topic or an in-class assignment is divided into **sub-topics**.
    - Example:

        Big topic: Flight Control Surfaces

        Sub-topics: Ailerons, Rudder, Elevator, Flaps, Slats

2. Students are then split into groups with one group assigned to each topic. This is called the **Expert**

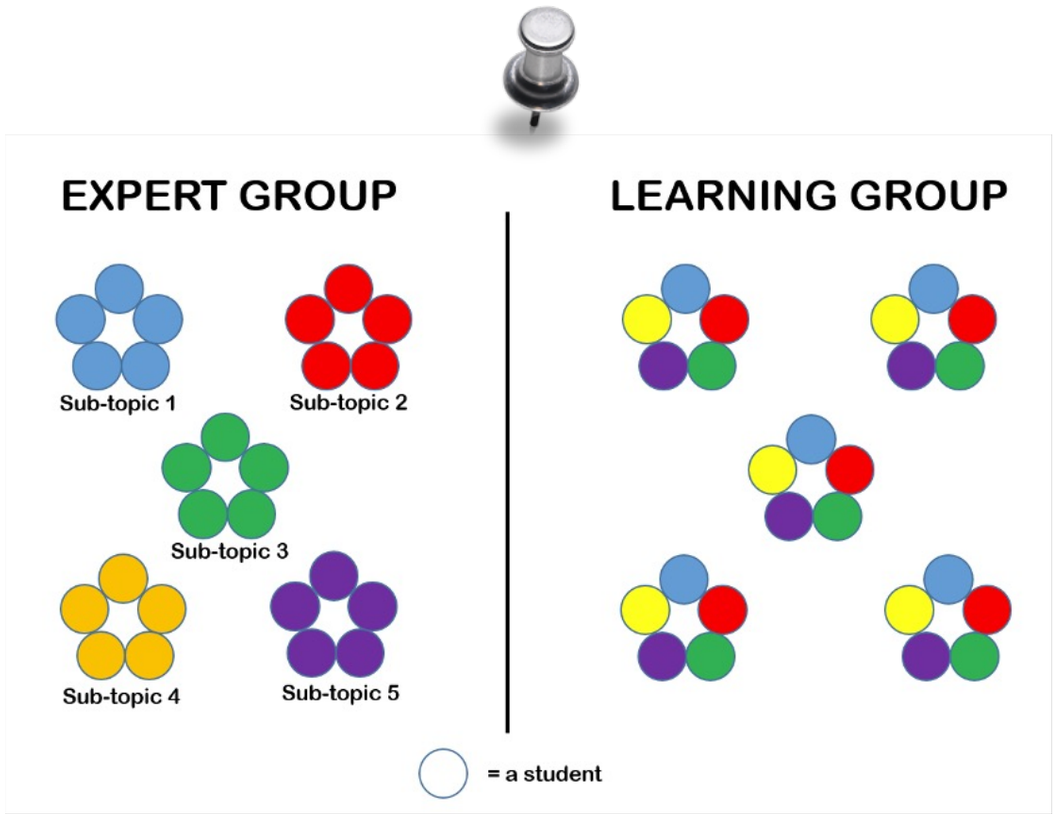
Group. They work together on understanding the sub-topic at hand and create teaching material (usually a one page note) to prepare for the next phase. Suggested time: 20 minutes.

3. Next, the class is split again into the **Learning Groups**. Each **Learning Group** has at least one member for every Expert Group, representing all the sub-topics given earlier. Each student presents the sub-topic to the members of the group. Each **Learning Group** member compiles the notes. Suggested time: 40 minutes.

4. Finally, the original **Expert Groups** reconvene and compare notes. This final presentation provides all group members with the findings that have emerged from the **Learning Group** discussion. Suggested time: 20 minutes.

Pro-tip: Use a big clock or a timer to control the discussion time – because they will almost definitely go over the 2-hour period.

So what do you do? Brief the learning outcomes and the learning process clearly. And then, sit back, keep time, and let the learning happen. Facilitate the discussion by giving feedback once in a while during the group discussions. Don't forget to practice a



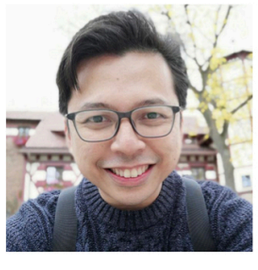
little reflection at the end of the class as a closure. Try on simpler, easily digestible topics to experiment. In my own experience, it took me at least two attempts to get it right and flowing.

“Congratulations, you have now transformed your 50-page walls-of-text Powerpoint slides into one meaningful learning activity.”

After experimenting with this, I realized that my previous attempts at student-centered learning were lacking the elements of interdependence and individual responsibility. The students didn’t feel the need to learn with and from the rest. In group work, they don’t feel the responsibility to learn and contribute. The jigsaw technique I think tackles both problems quite nicely. The sense of responsibility comes when they realize that they need to present something to their peers. This is instilled when they are preparing materials in the first phase Expert Group. Then, the students depend on each other when they need to learn about the big topic (complete the ‘jigsaw’) in the Learning Group.

Ideally, I would like for all my students to learn how to work cooperatively with others, compete for fun and enjoyment, and work autonomously on their own. The lecturer’s role is to decide which goal structure to implement within each lesson. To do this, again, it is important for the students to have a sense of authority, a will to dictate their own learning – responsibly.

Author:



Dr Salah is a Senior Lecturer at the Department of Aerospace Engineering. He spends too much time on the innovation of teaching and learning at the Faculty of Engineering and the University. This is one part of the series on Atomic Teaching - Little Change, Big Impact which aims to introduce simple and practical ideas to improve teaching in engineering.

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