Teaching-Learning Newsletter

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School of Chemical & Biotechnology

நற்றமிழ் கூறும் ஆசிரியம்

கோடல் கூற்று:

கோடல் மரபே கூறுங் காலைப்
பொழுதோடு சென்று, வழிபடல் முனியான்,
குணத்தோடு பழகி, அவன் குறிப்பின் சார்ந்து,
"இரு" என இருந்து, "சொல்" எனச் சொல்லிப்,
பருகுவன் அன்ன ஆர்வத்தன் ஆகிச்
சித்திரப் பாவையின் அத்தகவு அடங்கிச்
செவிவா யாக, நெஞ்சு களனாகக்
கேட்டவை கேட்டவை விடாது உளத்து அமைத்துப்
"போ" எனப் போதல் என்மனார் புலவர்

-- **நன்னூல்**

தெளிவுரை: பாடம் கேட்கும் இயல்பைச் சொல்லுமிடத்து, தகுந்த காலத்தில் ஆசிரியரிடம் சென்று, அவரை வழிபடுவதில் வெறுப்பு இல்லாதவராய் அவர் குணத்திற்கு ஏற்பப் பொருந்தி பழகி, அவர் குறிப்பினை அறிந்து, "இரு" என உரைத்தப் பின்னர் அமர்ந்து, "சொல்" எனச் சொன்ன பின்னர்ச் சொல்லி, பசி உடையவன் உணவில் கொள்ளும் வேட்கையைப் போலப் பாடம் கேட்பதில் வேட்கை உடையவனாய் ஓவியத்தில் உள்ள வடிவங்களைப் போல அசையாமல் இருந்து, செவியே வாயாகவும் நெஞ்சே கொள்ளும் இடமாகவும் கொண்டு, முன்பு கேட்டவற்றைத் திரும்பவும் கேட்டு, அவற்றை மறந்து விடாமல் மனதில் நிறைத்துக் கொண்டு "போ" என சொன்ன பின் போதல் வேண்டும் என்று புலவர் உரைப்பார்.

(Dr. Lalitha Bala, School of Education, SASTRA)

Tamil Literature, Nannool, on Learning: *This verse speaks about how one should learn from a teacher. The learner should approach the teacher with gratitude; should sit and talk only after being told so; should devour knowledge as a hungry person eats food, through the ears and with mind as the place of knowledge storage. Without forgetting what is learnt, should go only after the teacher says "go".* ***(Translation by Vigneshwar Ramakrishnan, SCBT, SASTRA)***

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Editorial

'*Pandemia*' – Academia During a Pandemic

It was the end of 2019, when a nano-sized entity brought the entire humankind down to its knees. Reeling from 'never-seen-before' worries that plagued every sector of the world; speculations, uncertainties and restrictions wreaked havoc on the minds of young and old. While 'social distancing' is the need of the hour, staying 'connected' is the most sought-after option. Thanks to Babbage, Berners-Lee, Kahn and Cerf (not in any specific order though), 'connections' can now be maintained even while staying apart by miles and more. Conversion of 'stay away from the internet' to 'please stay connected' has been a critical outcome of these difficult times. Academia, in particular, needs to tackle plausible long-term challenges that have been imposed by this global pandemic. Shedding off the 'conventional' modes of physical classroom setups, students and teachers had/have to engage themselves in remote learning. Getting a grip over the several challenges that could have been easily avoided in a non-virtual set-up has become the utmost worry of the academic paraphernalia. For example, internet access and its round-the-clock availability is a foremost concern. Say, while in a physical class, a sleepy student can be easily noticed and cajoled to pay attention, such monitoring might not always be feasible virtually (maybe the camera is not working/there is no internet). The list of challenges is bountiful but like any silver lining to a dark cloud, '*pandemia*' has

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coaxed tutors and learners to think of innovative strategies to strengthen the teaching-learning experience. This issue is a collage of our colleagues' experiences, their strategies, predicaments and their own views about teaching in this era of virtual learning. While, students and teachers (alike) are trying to mould themselves according to the pressing demands of the current times, sharing each others' experiences can bridge the gap of real and virtual. This can consequently bring about the much-needed relief in the arena of 'pandemia'.

--- Editors.

Online teaching during the corona pandemic

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Consequent to the ongoing COVID-19 pandemic, online education has taken a routine shift from traditional method of teaching, to the modern approach of online teaching using different platforms such as google classroom, Zoom; from personal to virtual and from seminars to webinars. Before this pandemic set sail, online teaching was considered as a non-formal teaching mode, but a scenario that has now been changed due to this pandemic. Higher education all across the world got affected severely. Undoubtedly, online teaching mode became the only option that brought both an organization and an individual both in an unfrozen phase. Therefore, the Government of India hosted different online courses in Study Webs of Active-Learning for Young Aspiring Minds (SWAYAM) or Massive Open Online Courses (MOOC). Similarly, MHRD initiated e-PG Pathshala run by the University Grants Commission (UGC) that provided interactive high-quality e-content in 70 subjects across all disciplines.

Some students struggled to participate in online learning without reliable internet access. Even sometimes, background noise from students interrupted our teaching but I feel, students being able to learn faster online with more study material as compared to face-to-face classroom. Nevertheless, the effectiveness of online learning varies amongst age groups. Kids are more easily distracted during online classes. As a teacher, we exactly don't know whether they are listening to us or not. Our teaching must include interactive diagrams, videos and some teaching gadgets to make them stay engaged in learning. Only textual content bores them out. We must encourage them to question us which will enhance their creative thinking.

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I started to use laptop for online teaching. Initially, I faced some technical difficulties such as camera, sound, internet connectivity. Later, it became a routine part of my teaching. Gradually, I also started learning all kinds of teaching platforms and online assessments. I tried to engage my students through interactive slides, videos and timely questioning.

As a teacher, I experienced the following situation during online teaching:

Creative thinking: I remember, I was teaching functions in Python class. I taught only basic syntax of python and small programs. One student asked me if a function could be used to create a simple game. I just asked him about logic. He told about shuffle library and input function. He not only proposed the concept but he wrote the program in few minutes and to my surprise, it was working properly. To be honest, sometimes I feel that I am learning from my students.

Another case was during my Cheminformatics class; I was describing the concept of pharmacophore and I just asked about the utility of MCS (Maximum Common Subgraph). One student willingly came up with the idea of virtual screening using 3D-

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pharmacophore and she wrote MCS code in R for two compounds. I felt that in order to induce their thinking in a more constructive way, we should ask real-time questions. In another such class, I was speaking about peptide-based vaccine. Most of the students found this topic interesting and asked several questions related to this. Next day, one student came with the protocol for *in-silico* peptide design. He made little modification on the "Substractive genomics" protocol and justified it with a sensible logic. I wasn't judging him but I was quite impressed that students are thinking out of the box. Definitely, if they pursue this attitude, they will touch the sky...

I hope even after this pandemic, this online teaching continues along with the traditional way of teaching.

It is overall a good experience. Cheers!!!!

Enabling virtual team work among students

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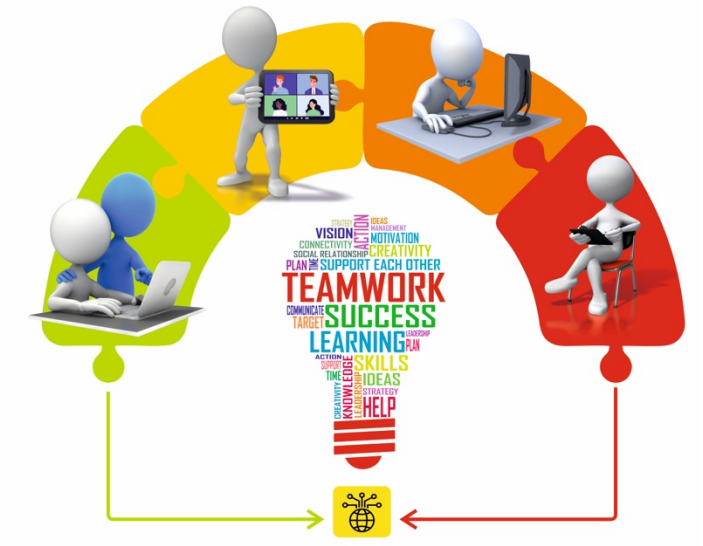

Teamwork is considered one of the essential learning outcomes of academic programs. Prospective employers consider this as a prime factor for employee's success. Group activities that are part of academic programs are known to enhance socializing skills and reinforce academic learning. But what about the possibilities of effective team activities during the current pandemic period when all the students are isolated at their homes? Isn't it worth conducting team activities as part of online courses?

When I tried to include team activities in the courses handled by me, the response and involvement of the students were encouraging. I would like to share the teamwork activities included in the courses, their benefits and challenges, and the reflections and experiences shared by the students during a follow up survey. Essentially, students feel that such group work opportunities enabled interactions among classmates during this pandemic period.

The word TEAM stands for - together everyone achieves more. It is essentially true that group assignments and team projects have an added impact on student's development and learning. According to principle 12 of Napoleon Hill, teamwork is the willing cooperation and coordination of effort to achieve a common goal. The harmonious cooperation among the team members gives pleasure and thus learning becomes a joyful experience. Yet is this harmonious cooperation always achieved in teams?

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Do all the team members contribute equally to the task and learn properly? These were the concerns when the team activities were given to students. Different factors contribute to the effective coordination of the team members and their involvement. The number of team members is an important factor. Usually, small teams with four to five

members perform better when compared to large teams. I have tried team self-selection and team assignment approaches and noticed that the self-selected teams have better coordination. Some of the assigned groups struggled with misunderstandings among the members. The team leader's coordinating skill also plays a role in effective teamwork. During team selection, inclusion of members with complementary skill sets is another winning strategy. But most of the time it is difficult to put heterogeneous members in a team for class assignments as the context changes in relation to the assignment type, topic, or course. Regarding the time commitment for team activities, students may need to find extra time for team discussions and doing the assignments. The group presentation activities may be delayed and sometimes it requires extra hours to complete the assessment. Considering these constraints, one or two team activities can be included in a course without much strain.

The activities given for teamwork include demonstration video preparation, article presentation, term paper assignments, dataset presentation, group discussion based on a topic and group projects. These are all part of the courses, NGS methods for 6th semester B.Tech. Bioinformatics, Healthcare Data Science for 2nd semester M.Sc. Data Science and are also assigned to the project trainees and internship students in my lab. The collective effort of team members was found to augment the learning process and resulted in a better understanding of the topics. In one of the team assignments to prepare a demonstration video of NGS methods, the students came up with 10-20 minutes videos to explain the different generations of DNA sequencing methods. Some groups included innovative ways to explain the mechanism using animations and a coordinated visual play of team members along with effective demonstrations. The team members said that they understood the topics very well during the discussion with other team members. The team members clarified the doubts in the NGS methods among themselves, making it an effective collaborative learning experience for them. The advantages of teamwork activities include knowledge exchange, expertise sharing, critical thinking, time management, decision making, conflict management and many more. Such activities can also promote the capacity to communicate effectively with others through different forms of oral, written, ICT, visual and multimedia methods.

A follow-up survey was conducted among the students included in teamwork activities and 98% of them confirmed their interest in being involved in team activities. Around 40% of the students reported that they were not getting sufficient chances of team activities. Multiple team discussions, planning of the work, task assignment and follow-up were done by team members using various platforms. Regarding the media of communication for team activities, various teams used video/audio conferencing, conference calls and group chat options. The platforms such as ZOOM, Google Meet, Microsoft TEAMS and WhatsApp were used by the majority of the teams. The new collaboration/communication platforms such as miroboard, discord was also used. Some students reported that there were misunderstandings, tension, pressure, and unavailability of members during the team activities, but as a team, they could solve the issues and successfully complete the task. The students listed out the benefits of learning aspects and social skills when asked about the benefits of virtual teamwork. The students' responses are listed below. The responses of the students from the survey can be viewed at:
https://drive.google.com/file/d/1y912or3pP1iLWfVkSp-sTRAs3LmBUHoD/view
According to students, the benefits of virtual teamwork activities include:

(i) Knowledge exchange
(ii) Room for sharing skills and knowledge
(iii) Makes study interesting

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(iv) Getting information from various perspecives
(v) Lot of new ideas
(vi) Sharing of thoughts helps in understanding new concepts
(vii) Learnt to fix mistakes as a team instead of blaming others
(viii) Guidance to fix errors
(ix) It is hard when doing project assignments individually. And it seems easy when doing it as a team.
(x) Able to work together even when they were not physically present
(xi) Coordinating with the whole team
(xii) Time management
(xiii) Leadership skills
(xiv) Taking initiatives and knowing to handle a team
(xv) Social relationship
(xvi) Mutual understanding
(xvii) Getting to know others
(xviii) Effectively communicate with colleagues
(xix) Develop coordination skills
(xx) Improving communication
(xxi) Develop patience when team members are not responding properly

The challenges faced by the students when they involve in virtual teamwork includes technical issues, mainly internet connectivity. Some members feel that the team activities will be more effective if they were in college. Another important issue was with the non-participating team members. Such members were not actively involved in the discussion and were not communicating properly and hence often delay the work. Some members were found to have the fear of socializing and so did not involve in conversations. In some cases, health and family issues found to affect the individual member's involvement in teamwork. There are issues like communication gaps due to online conversations. Differences in opinion also crept up during discussion and the team had to manage such conflicts. There was difficulty in finding a convenient time to discuss with team members. Even though there were challenges, all the teams were able to tackle the challenges and could succeed in their endeavour.

As described above, the inclusion of teamwork activities in academics can impart various skills necessary for a graduand. I am happy with the students' responses to team activities and would like to include more team activities in my courses. There is always scope for innovative practices in team formation and activities, and that itself is a topic for research. I am sure that many of my faculty colleagues are also including effective team activities in their courses and might have even better experiences. Very importantly, for students, such virtual team activities are a way to engage and interact with classmates during this period of isolation. A virtual way to reconnect….

Documenting learning trajectory

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Learning requires conscious investment of time and most often is *not* a linear process. Students often get anxious when they have a doubt or a query and wish those to be 'answered' instantly or assume that they could get the solution in 'no' time or 'less' time. I am not sure, if this is a consequence of growing creed of doing a process faster or because academic indicators are often fueled by who completes first. Let us park these aside and focus on the 'time' investment into learning. It is very important that a student (or a learner) should understand that the process of learning takes meaningful engagement with what is being learnt and the 'learning' itself changes as 'time' is rightfully spent on learning.

Further, we often wish to inculcate the aspect of self-learning in a student. However, unconsciously we do not get to nurture it in a continual basis. One aspect

of self-learning is to make oneself understand that it takes 'time' and 'effort' to learn and that learning is a iterative process, both in terms of what is learnt and how it is learnt. When a student asks doubts, we do give answers on the notional perspective that we are helping students learn. Yes, this is true! However, is this the only outcome of our answering? Perhaps not. Are we not slowly encroaching the self-learning abilities of a student? Are we not giving a notional perspective that 'answers' are obtained instantly with greater ease than the effort taken to pose a question?

Are we not slowly encroaching the self-learning abilities of a student? Are we not giving a notional perspective that 'answers' are obtained instantly with greater ease than the effort taken to pose a question?

If we delve deeper, we will excavate various intricate and complex aspects of learning.

As a teacher, I wanted to trigger and nurture the aspects of self-learning in my students. I gave a suggestion to my students (regular course students and also to my Engineering final semester project students whom I guided) to keep track of their learning through a learning trajectory document. I asked them to write down their query as they got it during the lecture, or when they are working on a project, or reading the concept, or solving a tutorial problem. This could be any query or doubt connected to what they are learning. I advised them not to label any doubt as trivial or otherwise. They might get the answer or solution for their query either by reading, referring learning resources, or talking to their classmates, or to me, etc. This could happen over a period of time and not necessarily it is answered instantly. Whenever and whatever they could find or obtain as perceived solutions to their query, they can note it in their learning trajectory document. In this manner, I wanted them to realize how their own understanding evolved and wanted them to appreciate the 'time' taken to get a finer understanding of the same.

Documentation of learning trajectory is to enable students

- To clearly articulate their doubts, which would require them
  - To 'think' on what they learnt (listened / read).

B	C	D	E	F
Date of doubt generation	**Doubt Generated**	**Origin of Doubt**	**Resolving Date**	**Answer**
11 Mar 2021	KON	Looking on paper num 7	12 Mar 2021	the behavior of the fuel in the engine at lower temperatures and
11 Mar 2021	MON	Looking on Paper num 7	12 Mar 2021	describes the behavior of the fuel in the engine at high tempera
12 Mar 2021	LCV and IMportance	Looking on Paper num 7	12 Mar 2021	Amount of fuel produced when one unit of fuel is burnt compl
04 Apr 2021	Atom Economy	Greener Process: Paper 38	04 Apr 2021	The atom economy (a measure of atom utilisation or efficiency
04 Apr 2021	What is thermodynamic feasibility	Process Selection Excel	06 Apr 2021	Shows about the directionality of the reactionNegative: Exothe
04 Apr 2021	What is equilibrium conversion	Process Selection Excel	06 Apr 2021	Gives temperature limit for a particular process at aparticular c
			07 April 2021	Conversion decreases with increase in temperaturefor exotherm
30 Apr 2021	Why bubble point is negative	Discussion with Naren sir on Flash Excel	3 June 2021	The presence of gaseous components create aninfluence on buh
4 May 2021	Difference between gas and vapour	Discussion with Naren sir on ProcessDevelo	15 May 2021	Vapour: Substance above boiling pointGas: Substance above cr
5 May 2021	How to select LK and HK	while operating flash column	12 May 2021	Line up the compounds on the basis of boilingpoint. The desire
7 May 2021	What is Thermodynamic Model	while operating flash column	8 May 2021	Set of operation to calculate four type of properties1. Phase Ec
25 May 2021	Selection of Tube Pitch	While designing heat exchanger	25 May 2021	For OD smaller than 1, square pitch can be usedFo higher OD,
27 May 2021	Height of Sump	While designing reflux drum	27 May 2021	Height can be assumed as 10 foot
28 May 2021	Why oxygen and carbon monoxide cannot beliquid a	Discussion with Naren sir onsecond review	29 May 2021	This is because of the property called criticaltemperature (the a
29 May 2021	What is weir	Performing column internals in Aspen	29 May 2021	Function of weir is to maintain a desired liquidlevel on the tray Increasing weir height can increase channel'scross section redu
29 May 2021	Purpose of Reflux Ratio	Learning about Distillation Column	31 May 2021	To provide contact between down flowing liquid withup flowin
29 May 2021	What happens if relux ratio is increased ordecreased	Learning about Distillation Column	31 May 2021	Higher reflux ratio:More vapour-liquid contact, so higher purity
29 May 2021	Influence of feed stage column location	Learning about Distillation Column	31 May 2021	Feed stage influences presence of more volatilecompound in bo
06 Jun 2021	What is 1% entrainment assumed	Looking on Dharani Akka report	07 June 2021	It is 1% leakage taken from inlet blocks
06 Jun 2021	Reason to perform effluent treatment	Looking on Dharani Akka report	07 June 2021	TO ensure that discharged effluents are non toxic
14 Jun 2021	Should pressure be higher in top or bottomof distilla	Discussion with Viswanth	14 Jun 2021	Pressure should be lower in the top part of thedistillation colu

- Once they write their own query, they would develop skills required to 'search' for solution(s)
- Evaluate those solution(s) and improve the solution(s) if necessary, which then would develop their self-learning.

Well, maintaining this learning trajectory was not mandated and I left to them to experiment and experience it. More so, I did not follow it up either, till about the end of the course / project, when I asked them to share with me, if they had maintained one.

Let us observe what one of my project students documented as part of this learning trajectory.

The focus in the screenshot is not on the technical appropriateness of the content displayed but on the concept of making students to get to see their own progress in learning.

If you ask whether all students maintained such a trajectory, it is a simple answer – it is certainly a big NO! Only a few students (< 5 in a class of 70) started or even maintained their learning trajectory. There could be various reasons for it and certainly I need to 'invest' time to make this experiment to grow as a better experience. Some students did not maintain a separate document like the one shown above, but tried to write besides their class notes and documented it. Obviously how the learning trajectory is documented itself could get transformed based on their own experience and so on. There are certainly a sizable number of students who viewed this as either futile exercise or a time-intensive exercise with no perceivable benefit to them, or saw that this impeded their learning curiosity, as they had more doubts than solutions at a point of time!

This is the larger essence of a class. A class is a composite structure with heterogenous learning patterns. This activity reinforced that there is 'no' one best or one fixed method to achieve my teaching-learning goal! As a teacher, I need to be open with varied ideas. Having said so, I wish to 'invest' time in my next semester to re-do this experiment to better learn the process of nurturing self-learning. At the end, teaching-learning is an evolution.

Teaching scientific thinking through phenomenological modelling

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The word *Science* embodies two different notions: 1) a body of knowledge, (2) a way of constructing new body of knowledge through rigorous reasoning. While these two notions conflate at a later stage in the higher education landscape (for eg., in a PhD), it is quite often the former that is emphasized in schools, UG and PG programmes. Can we make a paradigm shift to bring the focus to ways of constructing new body of knowledge even in the lower rungs of the academic ladder – *within* the curriculum? What I share here is a tryst with this question.

Scientific thinking – science as a way of constructing new body of knowledge – involves, *at the least*, observations and coming up with explanations for the observations. The course Physical Biology in the M. Sc. Bioinformatics programme lent itself out well for teaching this. While the idea behind the course in the programme is to help students get a flavour for quantitative thinking in biology and in familiarizing themselves to the various spatio-temporal and energy scales in operation in biology – something very important for a bioinformatician in interpreting data – it had a substantial portion of phenomenological modelling and thus turned out to be a good ground to help students understand scientific thinking as well. Here, I briefly outline only the part that pertains to helping students understand scientific thinking through phenomenological modelling.

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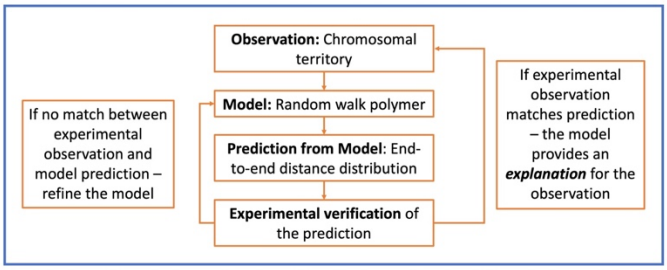
The course started with simple aspects of back-of-the-envelope calculations – to sensitize students to the idea of modelling. For instance, given that the "size" of the bacteria is one micrometer, what would be the volume of the bacteria? Here, the student can assume the bacteria as a sphere and the given "size" as the radius of the sphere and calculate the volume. In other words, a bacterium is *modelled* as a sphere and the space occupied by it is calculated using the mathematical formalisms for a sphere. Students were familiarized to such simple "modelling" using a variety of examples, from calculating the packaging density of DNA in viruses to calculating the number of rod cells on the retina. At each stage, the *assumptions* made were emphasized. To illustrate, when calculating the number of rod cells in the retina, one may assume that the retina is hemispherical in shape. This assumption invariably affects the conclusion (the number of rod cells). It is important to stress to students that we are making this *assumption* so that they understand the fallibility in the approach. This, I think is crucial before we take up the idea of illustrating observation-explanation process in science because explanation, in many cases, draws upon certain assumptions in existing theories, or sometimes, even requires us to creatively make assumptions. Once the idea of modelling was discussed at length, we turned to specific observations where modelling has been used to provide an explanation for the observations. A vivid example is the modelling of chromosomes to explain the observation of "chromosomal territories". In a dividing human embryo, it is observed that chromosome 18 is always at the polar end whereas the chromosome 19 is always at the equatorial plane. What explains this observation? How do we approach finding an explanation for this question? Without getting into the technicalities, let me briefly state in plain terms how one could go about it. One could assume that the chromosome as a random walk polymer and make *predictions* of its end-to-end distance. The end-to-end distance can be experimentally characterized. If the predictions of the model and the experimental observations match, then, the model is valid and explains the primary observation (chromosomal territory). In the case of chromosomal territories, obviously the random walk model predictions did not match the observations. One had to make the assumption of *tethered random walk* for the prediction to match experimental observations. The figure below shows the essence of scientific thinking using phenomenological modelling.



In essence, the idea of scientific thinking as a process of coming up with explanations for observations was effectively communicated to students. It would probably take another couple of offerings of the course to modify it such that I can move from merely helping students *understand* scientific thinking to helping them actually construct explanations for observations. The advantage of using phenomenological modelling is that it offers itself to making testable predictions and, with a bit of careful structuring, it can be done in class. This being offered in the online mode and with multiple other learning outcomes to meet, I hadn't quite evaluated the extent to which this aspect reached students. Based on informal feedback, I understood that they "enjoyed" the problems because they "know" that there is nothing that is right or wrong. My own interpretation of this feedback is that they understood the idea of assumption making. However, it is not clear if they understood the part about validating the assumptions through predictions. I guess these are some of the pitfalls of aiming at such learning goals in an online mode. Adding to this is the fact that these students are from a biology background – with a huge

mathophobia! Hoping to implement some online strategies to overcome the mathophobia and systematically evaluate the extent to which students have imbibed the concept of modelling and scientific thinking.

While data-driven modelling is thought to be revolutionizing the scientific world, it must be accompanied with phenomenological modelling to make meaningful progress in my opinion. In addition, if we agree that it is important to help students to develop the abilities for constructing scientific knowledge, then, phenomenological modelling is one powerful tool in our hand – *within* the curriculum.

if we agree that it is important to help students to develop the abilities for constructing scientific knowledge, then, phenomenological modelling is one powerful tool in our hand – within the curriculum.

Phenomenological modelling spans all disciplines of engineering as well. Therefore, it is quite possible to use phenomenological modelling as a terrain to develop the scientific thinking abilities of students. Further, if we agree that helping students develop abilities to construct knowledge is an important goal of science education, then, we must find and flesh out such pockets of scope *within* the curriculum to produce better scientists of tomorrow! This is an invitation to all fellow colleagues to join hands in this endeavour!

Some upcoming conferences on teaching and education

1. 20th World Education Summit – Higher Education. 22 – 24 September 2021 https://wes.eletsonline.com/he/
2. ISSOTL2021: 26 -29 October 2021 https://issotl.com/issotl21/
3. SoTL Commons Conference, Feb 23 – 25, 2022 https://academics.georgiasouthern.edu/sotlgsu/commons/
4. 8th International Conference on Education 2022 (ICEDU 2022) 24 – 26 March 2022 https://educationconference.co
5. EuroSoTL: 16 - 17 June, 2022 https://www.uta.mmu.ac.uk//eurosotl/index.php

Books of interest

1. *Improving How Universities Teach Science* by Carl Wieman
2. *The Missing Course: Everything They Never Taught You about College Teaching* by David Gooblar
3. *Failure to Disrupt: Why Technology Alone Can't Transform Education* by Justin Reich
4. *How we Teach Science – What's changed, and Why it Matters* by John L. Rudolph

Journals of interest

1. Journal of Perspectives in Applied Academic Practice: https://jpaap.napier.ac.uk/index.php/JPAAP
2. The Journal of Effective Teaching: https://uncw.edu/jet/
3. Active Learning in Higher Education: https://journals.sagepub.com/home/alh
4. Higher Education Research & Development: https://www.tandfonline.com/toc/cher20/current
5. Research in Higher Education: https://www.springer.com/journal/11162

Forthcoming issues

We welcome articles for this newsletter from all of you along various dimensions of the teaching-learning process. It is being planned that the newsletter will be

released just before the vacation period starts every semester. A call for articles will be made once the semester begins. However, you don't really have to wait until then to plan for it. You can send in your articles at any time in the semester to stl@scbt.sastra.ac.in

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