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Impact of PID controller to enhance the stability of control system

Ghanendra Kumar[a] and Chakresh Kumar*[b]
[a]Department of Electronics and Communication Engineering, National Institute of Technology, Delhi-110040, India
[b]University School of Information, Communication & Technology, Guru Gobind Singh IP University, New Delhi
*mail-id: chakreshk@gmail.com

Abstract-The method of teaching in any level of education is the core purpose which can help in the student's practical and theoretical knowledge grasp during their educational tenures. The research work was mainly focused on the medieval years of under-graduate and more deeply focused on control engineering subject in mechanical engineering subject. Different modes of training the students in the subject of control engineering involves techniques, video monitoring and in-student researchers were also involved in this study. Spread across six major points the research work is still under initial observations as the best way for an educating pattern is still being achieved for the future years of studies.
Keywords- Virtual instrumentation, PID controller, education

(I) Introduction

Researchers Jessica Swenson, Ethan Danahy and William Messner from Tufts University were highly involved in this research work as they studied all the initial aspects noted from readings observed from the student's reaction-behaviour to the tests. All this research was mainly focused on the student's life cycle noted in the mid-year (as referred by the researchers). Since a basic 4-year criterion for an undergraduate is most commonly observed around the world, the subject distribution throughout the course is the main concern for this research. As mentioned by the authors of this research, the initial and the final years of studies in under-graduate are mentioned as the corner-stone and cap-stone years of education. The basic or overlay-topics are most commonly arranged in these corner and cap-stone years. As a result of this arrangement, the core subjects relating to the respected engineering subjects are fitted in the mid-years of studies. It is in these core subjects where the laboratory works plays the most important role in the under-graduate student's life regarding their interests in topics for their master's degrees. This issue of interest-arousal in the student's regular curriculum is the talking aspect of this report that can be solved by the different modes of educating setups. Today's college-going under-graduate student faces the crisis of finding the notes or study material for their learning setup. Not only study materials, laboratory resources are also being found outside four walls. Generally found in University estates, professors are nowadays holding their personal labs also not to forget the online emulators/simulators are available on various websites or can be licensed. Tutorials point, edX, Courser these days run their own online courses that even attached to various deemed universities (like MIT, Harvard's and Tufts). As a result, a longevity between the students and the teachers have started to be affected. Though the laboratories maybe a purely virgin model for raw-structure mode of education to use the theoretical class-based study material use. The online structures maybe useful for the students but the transient relation with the teacher have started to hinder (as a result of the modernization of world through internet). Despite lecture-based method of teaching in colleges are mostly used, the research has been completely been focused on the ways experimenting the bookend knowledge testing with different procedures in lecture-based structures.

IRL-The author tries to bring up the topics of requirement of laboratories and its importance (how multiple forms of laboratories have been created in the past 10 years – them being personal, university-level and online based), along with the topic of the mode of education – which has seen a rise in online based courses (the author mentions edX, Khan Academy, Coursera as examples).

(II) Literature Review

An engineering course in a student's life is mainly motivated by a course syllabus defined separately for each course. And this syllabus clearly points theirs brains to a bookend knowledge. By this bookend knowledge, the theoretical part and practical parts of a student study environment vastly runs away from their interest driving motivations. A bookend knowledge restricts the mind efforts in retaining the knowledge more than its implementation. This bookend knowledge affects the middle years of this under-graduate's desire for his practical/research interest for his future years' efforts.

IRL-It is these subjects in which the master's courses are mostly based on and often is the major point that can ignite the required interests for the topics in the students' curriculum.

Conceptual Knowledge

As the name suggests, conceptual knowledge has been researched on prior by different scholar – naming few of them are Streveler, Litzinger, Miller and Steif around 2008 to 2010s. According to their researches – "Conceptual knowledge can be understood as a transducer effect where one type of context can be related to another type. For example a homework provided in the school/college can be related to the study materials that have been provided the institutions in order to grasp the textual-knowledge within them. These means can be explained as a future goal set to achieve the students' lacking interest towards the practicality of the concerned subject or course."

IRL-As mentioned in a one of examples from their results – two students were provided with one problem to solve. All of these were being noted by six experts, by observing the simulations through them – one being a stronger student (theoretical) and other one being weaker as compared. Since a control engineering question was proposed, as a result of this experiment was quite obvious as the theoretically strong student was able to draw the free-body diagram more easily than the weaker student.

Control Education

Laboratory is an important part as practical is far more different than theoretical knowledge. For Example- Understanding the theory of car does not make a driver. Now a day's, universities focus on laboratories as we have our regular control and communication lab so that we can understand better. It is a really good step. As our country is growing digital, online experiments affect the student more, as they feel close to or familiar to it more. Practical is the major difference between arts and science. In arts (social subjects), theory alone is enough but in science (applied subjects) practical plays a more important role

(III) Course Description

IRL-Control system is a global course as we see it also being taught in United States. The teaching methods discussed here can be improved by regularly taking the lecture of 45 minutes, 4 days a week along with 1 test and 1 assignment on the topics taught in the class. There is very much similarity in the teaching style in USA as seen in India. Also, we have our regular assignments, tests and laboratories. The difference being, we have more student in our classrooms (mainly due to the population in India), also we do not participate in research works – due to lack of motivation towards. MATLAB is important software to solve various emergency problems, should also be taught in our courses for laboratories. The following table was made in order to keep track of the students that were assigned to individual types of training methods

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SECTIONS	TOTAL STUDENTS	TEACHERS	GROUPS
A	30	3	5
B	30	2	5

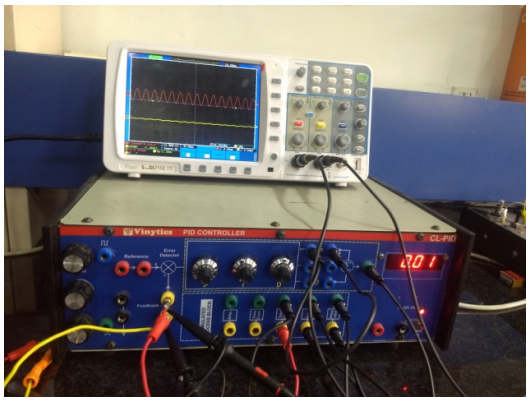

Fig.1 An example of the experiments that were to be performed during the laboratories Motor Encoder

(IV) Research Data Collections

Since the complete mechanical branch class was divided between two sections (A and B), the final result that was to be observed was to be in the laboratories responses. While Section-A were being taught in a practical based model where theory would be related to working practical body models, Section-B stuck to a rather more of a modified bookend version of studies where homework questions were revisited quite often in the class with the same two student logic being used. Not quite eminent of any results through the readings, readings were taken through the homework and laboratory sessions of different student groups in the respective sections. In total, a 24 hours video footage was recorded, with 6 hours being devoted in the homework solving sessions of the student group. The 18 hours video footage recorded in the laboratories of different section the student groups were recorded in such a way that the student groups won't be noticed about this research being done in background on them. This activity resulted in a more authentic manner of observations. As stated, 5 groups were being noted in the laboratories of each group perform the following sets of experiments.

GROUP-A	
LAB	**TOPIC**
Control Topics Through Difference Equations	Low Pass Filter Action Control, Proportional Control (PC), Integral Control (PI)
IR Distance Sensor Usage	Proportional Control (PC)
Motor Velocity Control	Working of Simulink in Motor Control
Temperature Control	Proportional-Integral (PI) Control
GROUP-B	
LAB	**TOPIC**
Motor Control Using Encoder	Proportional Control (PC), Proportional-Integral (PI) Control
Lab Continued	Proportional Control (PC), Proportional-Integral (PI) Control
Step Response	Step Response of a System

And additional note was taken to complete the required course content within the given set of timings. This was taken care of, to actually justify that the course material had been completed and the students' reaction could be noted so as the parallel timings of theoretical and laboratories could be matched.

[2] Taken straight from article – Think-a-loud protocols used in laboratories have been successful as they are often used to gather data through testing any specified product design, but are actually aimed to keep the student environment as natural as possible without hinting to a observing lens over them. All of these events and protocols are hence used to observe the conceptual knowledge testing without alerting the students

(V) Initial Observations

As a rookie researcher, the initial readings quite clearly showed that some kind issue hampered Section-B's laboratory experiments. As compared

to Section-A's 5 experiment topics Section-B could only complete mere 3 experimental topics. This could be blamed on the teaching methods implied during the theoretical classes. While the teaching part would be discussed later, in the laboratories whenever a discourse used to occur between the students in a group, the first concern would go towards procedural activities (checking whether the right procedures were being followed or not). The students would then go through interpreting results (earlier noted) or solving issues with the hardware and codes. This clearly displayed how the actual application of conceptual-knowledge was put at the back end of every problem (which was to be reversed in the actual expectations of the research methods). The conceptual knowledge was also discussed and was not completely declined through the discourse in the experiment performance in the laboratories, in order to make adjustments in the readings. Also was seen that the involvements of the professors or teaching assistants also created the discourse during the experiments which might have been expected as they might have entered to intervene in a wrong procedural approach or a theory check in order to know whether the students performing the experiments actually know what is being done in front of them or not.

IRL- A general mode for a desired experiment isn't often available, which the students could follow- leads to these debateable scenes during laboratories. The lack of prior conceptual-knowledge or even the training for a certain experiment with the Assistants can often cause confusion during the performances of the related experiments. Most of the times as mentioned in the Research Data Collection course completion is not always observed. This often results in a annoying laboratory experience, as the devices that are being used cannot be actually be understood by the students using it. This clearly demotivates their initial experience or interest for further practical performance.

(VI) Future Work

Since the complete research was not completed as the session is still left to complete various sets of exams to be taken. During the future research the video recordings made during the sessions shall be studied deeply While Section-A might be having been analysed, using a more real-life example-based model of studying control engineering, Section-B were clearly suffering in their completion of experiments in respective laboratory classes. Now a most common point, that stood out from Section-B's homework submission were – the homework questions asked to them were most often found int the textbooks that were being provided to them by Tufts University Library. This might have resulted them to skid-off their theoretical-practical interlinking during their lab periods. Section-A might have displayed more attractive results so far as compared to Section-B, the research work is still on as the University a well as the educational society around the globe still wants to find out the best way to train the students in the field of control engineering.

[2] Taken straight from article – The findings from the provided data would and have also been previously used to redesign the teaching structure in the field of control engineering in the wide varieties of universities and colleges across the globe who share this subject in their course syllabus

IRL-A scheduled method of educating in the classroom is more required than the research work on the students. A mixture of the practical as well as the theoretical method of teaching could provide the students with more exposure to the conceptual-knowledge. And a better performance in the laboratories with the knowledge to find the integral defects (if any) in the devices involved, make it easier for the students.

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