A Review of Interactive Learning Strategies in Higher Education Institutions

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Abstract : Agility, responsiveness and keen observation are some of the good qualities of great teachers. They always keep their mind open and try every possible way to best engage their students and get them excited about learning. This is possible only when they try out various interactive teaching styles in the classroom. Various instructional interactive teaching styles that are discussed in this paper are designed around one simple principle: to comprehend the study material in depth, practical knowledge is must. Theory without implementation with actual demonstration along with plenty of applicability is of no use. This paper reviews several professional development interactive instructional activities that are expected to boost higher education professionals to support education development in university teachers. The techniques discussed are evidence-based and have as such proven to be effective and efficient in higher education settings. The use of such activities will improve the learning skills in students and will achieve a better learning engagement of students in classrooms and laboratories. Experiential use of these activities will develop the professional background to develop their own training sessions in professional development centres in universities. All together six different techniques have been reviewed in the paper: Metaplan, Interactive questions, Video competence, peer assessment, collaborative learning and peer tutoring. The techniques focus on relatively independent strategies that teachers can adopt to invoke learning in their students.

IndexTerms **- interactive learning, instructional, strategies, metaplan, peer tutoring, interactive questions, peer assessment, collaborative learning, video competence**

I. INTRODUCTION

Agility, responsiveness and keen observation are some of the good qualities of great teachers. They always keep their mind open and try every possible way to best engage their students and get them excited about learning. This is possible only when they try out various interactive teaching styles in the classroom. Various instructional interactive teaching styles that are discussed in this paper are designed around one simple principle: to comprehend the study material in depth, practical knowledge is must. Theory without implementation with actual demonstration along with plenty of applicability is of no use. Several professional development interactive instructional activities that are expected to boost higher education professionals to support education development in university teachers have been discussed. Merely using a set of generic practices is not effective teaching. Effective teaching involves some decisions that are context based. It involves reflecting about your own work and relegating the teaching practice in a direction that is completely determined by whether students are learning or not. All together six different techniques have been reviewed in the paper. Every discussed technique has been presented with introduction, research base, examples and related available technological tools to support or implement the same in classroom environment. The paper is organized as follows: Next section discusses all the techniques one by one, followed by conclusion and references this document and are identified in italic type, within parentheses, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

II. INTERACTIVE LEARNING STRATEGIES

A. Metaplan

The approach was developed by a German company, called Metaplan. The credit of the technique goes to two brothers, Wolfgang and Eberhard Schnelle. Since its conception, it has evolved into a broadly used technique to structure the work of learning and problem solving groups. [1].

Figure 1: An example of metaplan technique in action[4]

For making group discussions more effective, metaplan is an effective technique. The meaning of effective here is twofold: saving time and deep involvement of participants. This results is agreeing on jointly supported opinions[3] The metaplan technique is an excellent technique for moderations. It supports a discussion by visualizing and interaction techniques together. In visualization as the name suggests the individual inputs by each participants is made visible to all. Later on they can be organized. Brain storming and fruitful discussions are carried out in the interaction technique which results in active participation among the participants. [2][3]

In the technique the individual's idea is developed and collected, through group discussion a unanimous or agreed upon solution is reached. This results in achieving a common understanding and formulation of action plan to work on the solution of the problem at end. Moderators also knows as facilitators in metaplan terminology are responsible for ensuring good communication , cooperation and achieving high levels of understanding among all group members. Their objective is to provide the group with the right sort of communication tools at the right moment. Metaplan internally uses the concept of dynamic programming whereas large problems (groups) are broken down into smaller ones (groups). This ensures that each and every participants involves in the activity. There are three main groups involved in the metaplan activity: plenary (1-3 people) group, sub-group (20-25 people) and the mini group(4-6 people). The function carried out by plenary group is to sets the task and reviews the results. The second group focus on the sub-tasks and gather the ideas. The last group is responsible for working on the issues if any present in the subtask.[2][3]

As an example each participant writes on a card some point of discussion on its own. After this, all cards are randomly collected so that it is not obvious who wrote which card. Then various clusters are formed by picking each card and assigning to different or same cluster after discussion among participants.
Another example, the question to be discussed was: "What is important in order to get to know the patients' requirements and the patients' satisfaction?" After this, all cards are randomly collected so that it is not obvious who wrote which card. Then various clusters are formed by picking each card and assigning to different or same cluster (treatment quality, organization, quality of participants) after discussion among participants.[4]

Figure 2: metaplan : discussion of ideas gathered

Some of the main advantages of metaplan which can be seen clearly from the above discussions are: that it forces every individual to contribute, result in more input than the number of participants in a group, You immediately get things to discuss that go beyond opinions, agreements, You easily find a "shared" perspective as to the answer to the question at hand.[3][4]

In this "early" study [5] Metaplan was used to look for effective "evaluation" strategies. In this second - medical study [6] Metaplan is used as an intervention and data collection approach.

Looking at the technical dimension of metaplan one tool that aptly mimics metaplan in an online distributed learning environment is noteapp [7]. This first example requires participants to register with their laptops, tablets, PDAs, ... Surf to [7] and create a free account. Next you can create a "board" and change the settings that "all" who get the URL of the "board" might contribute.

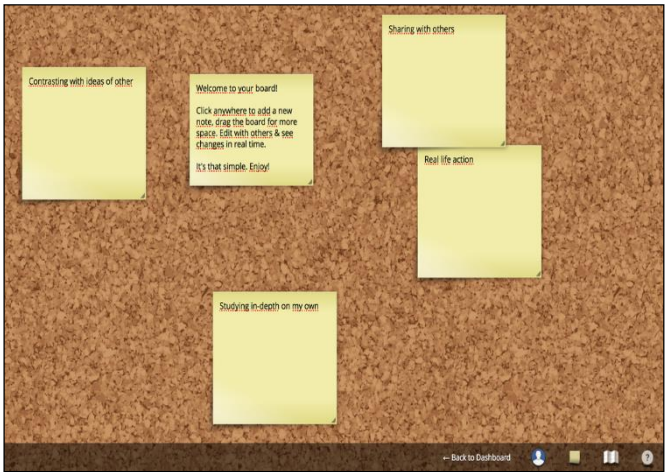

Figure 3: How noteapp online board [7]

Second tool is Dropbox Paper. The tool is only usable if you have a Dropbox account and if all "collaborators" are in your contact list otherwise you need to type their email addresses

Figure 4: Dropbox paper[8]

B. Interactive Questions

Questions are the backbone of instruction. They drive the actual learning process of students and either hinder or boost their "active" engagement in the process. Asking questions during a session or lecture makes it interactive and that leads to active learning. The questions to be asked by the lecturer must be designed considering some taxonomy like Bloom's taxonomy[9] or some other taxonomy when delivering the lecture face to face [10]

The question of types of questions was addressed by [11] and as shown in the figure: Fundamental questions basic questions to have an understanding in the field of science. Big questions are kind of elaborative type. The labels general or specific refer to the size of the conceptual scope or inclusiveness of the domain addressed. Questions concern with societal interest are important questions, whereas questions arising with personal interest are interesting questions . These types of questions are not mutually exclusive.

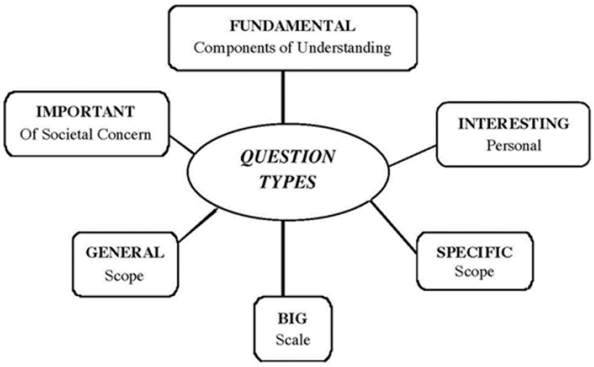

Figure 5: Types of questions [11]

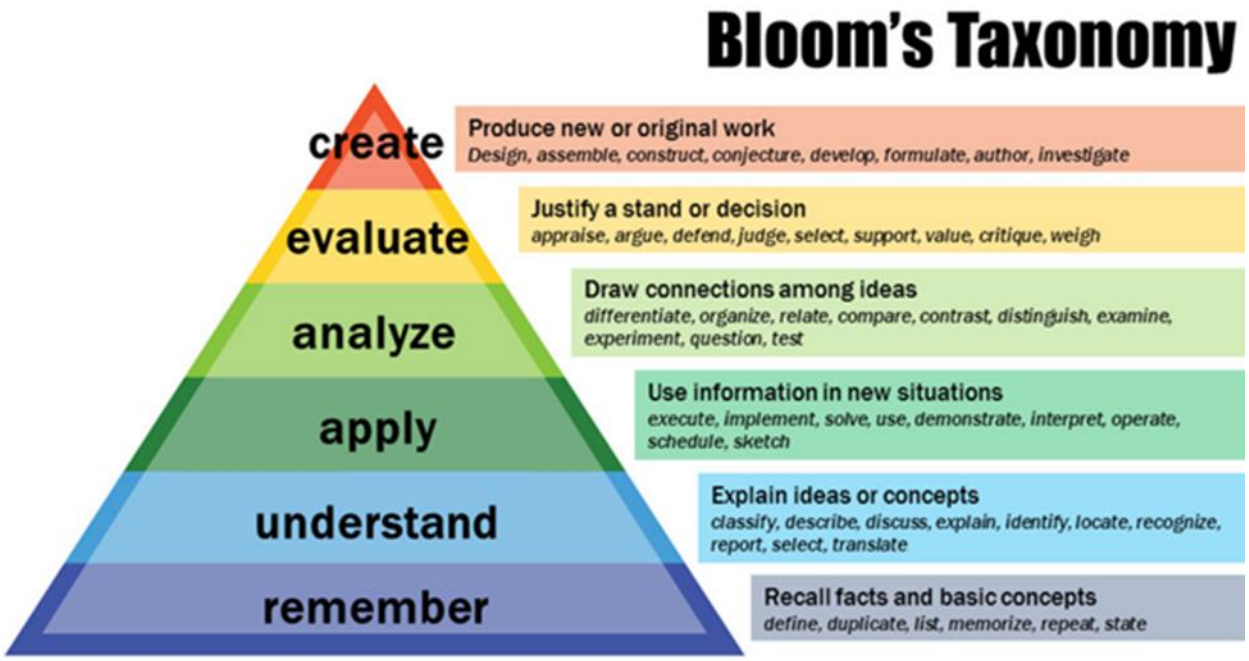

Figure 6: Bloom's revised taxonomy [12]

Though there are number of approaches exist in literature for classification of questions, but the dominant approach is based on taxonomy. Such a taxonomy is a structured way of looking at the aims of your course, program, and class activities. A key characteristic of "Taxonomies" is that they are hierarchical and as such imply that higher level objectives imply you master lower level objectives [9][11]. One of the very popular taxonomy being used in literature is the revised version of Bloom's taxonomy [9][12]:

Questions related to designing, assembling, constructing, developing, investigating come under the category of "create". It uses the cognitive aspects of the brain. At the lower level questions are a kind of just remembering the read concepts. The interactive questions must have a proper balance with reference to Bloom's taxonomy.
Caldwell[13] pushed the idea of using clickers in the class room for interactive questions. Clickers are an example of response and also available now a days in the form of apps on mobile and laptops.

Shea [14] showed how technology evolves, but the key remains the development of good questions to push deep level thinking and student engagement
Going in technological dimension one of the response tool that is quite popular is Socrative [15]. . As a instructor or teacher you can create your own account and launch quizzes. The students join to your rooms and participates in the quiz. They can use either their mobile phones or laptops.
Another approach related to interactive questions is to let students prepare their own questions and bring to classroom. This approach also engage students actively in learning.
It was [16] who pioneered in this direction and did number of studies to prove efficacy of this approach. She presents to her students cues that elicit the development and generation of a variety of questions linked to the taxonomy of Bloom. Depending on the nature of the cues, higher level cognitive processing was elicited in the students.
In this early meta-analysis study[17] Redfield and Rousseau point out that the quality of teacher questions has a significant impact of student learning performance.
In this Swedish-Rwandese study[18] Researchers could conclude that when students generated questions, they acted as more knowledgeable others.
Even more recent literature [19] keeps repeating that teacher often underestimate the relevance and impact of student questions. In this article, the researchers present a meta-analytical overview and can conclude it has a clear impact on performance, next to multiple other variables and processes:
In this last study[20] researchers showed the impact of a tool to push question generation by students. The results show a clear impact on the number of higher level questions being developed by the students.

C. Video Competence

Video competence is developing competence through use of video. This new domain of interactive learning develops interactive learning through video to guarantee the development of complex competences. In this section the focus is on the instructional design base of what drives the use of video in complex competence development. [21]
To develop an Interactive Learning experience based on video-usage, we need to develop first a "script" or cognitive script. There are different ways to do this. But let's understand first as what is a script? These "scripts" are - according to [22]: "A script serves

as a guide for step wise events that are likely to happen and corresponding action for each of the events one believes are appropriate for them.". Key to develop competences is to understand the underlying "script" of a competence as it must be stored in a learner's memory.

As an example in Vietnam to upgrade initial medical education and to set up professional development of current medical doctors, Vietnamese doctors took an initiative to focus on the development of the patient consultation competency[21]

Figure 7 (a) : Script for patient treatment[21]

Figure 7 (b) : Discussion of Script and videos for patient treatment [21]

In the figure 7 above you see at the left hand two scenarios elaborated by some teams. On the right hand side, you see the "viewing" and discussion of each other's' video clips.

Key is that you experience how teaching "competences" is approached from a whole new angle when adopting video as an interactive learning approach.

Developing complex competences implies that learners develop a large number of these cognitive scripts and are put in a sufficiently rich number of settings to deploy, refine and further develop these scripts. Think again about the "patient consultation" competence. But now think about an elderly couple visiting a doctor, or a mother with a newborn baby, or a situation in which the doctor suspects physical abuse being at the base of the medical symptoms. Each and every case will require a further elaboration and organization of the initial script. The same serves as developing more n more videos to fully develop competence related to specific scenario. The videos thus developed can also be embedded in online learning environments[21].

Research about video-based development of competences is abundant; though mostly it is labelled with the concept of video simulations. In the context of dealing with "problems", patients, etc. the label changes to clinical simulations.

In this first research [23] online video-based simulations have been compared to traditional face-to-face based clinical simulations in the context of patient consultations: The online video-based approach was as good as the traditional F2F approach.

In this second - nursing [24] - an overview is presented of different simulation approaches. Video-based approaches fit into this growing educational field.

Some of the advantages of using videos in higher education for learning is that it offers visual perception. A moving image can help someone to see a process or realize how something works, moves, or performs. video can present information in a manner that is hard to describe through text.

From the technological dimension number of software are available for making videos and doing post recording processing of your videos. Some are paid and some are free. Camtasia [25], Wondershare Filmora[26] are some of the well known paid softwares which are excellent for video recording and editing. Kazam[27], Screencastomatic(free for first 15 minutes only)[28] etc are some of the free software for video recording.

D. Peer Assessment

Peer assessment is the little sister or brother of collaborative learning, often labelled as "peer learning". It is considered a catalyst of the individual and collaborative learning process. But there are many misunderstandings about the nature of peer assessment [29].

To make peer assessment effective [29] two questions need to be answered: first one is what type of instruments are going to be used? Second: is the student ready to be involved in peer assessment?

The most common form of peer assessment is to use "rubrics"[30][31]. To understand this see the figure where a rubric was designed. This starts with a clear definition of a learning objective or competence to be evaluated. Here the competency is "Implementing a productive group work activity". The rubric make use of three key angles to discuss the rubric in the figure:

•criteria: this is a decisive characteristic that has to be present in the process or product in order to reflect mastery of the learning objective or competence.

•quality indicators: this is a concrete description of the level in quality for a specific criterion.

- levels: this is a number of different quality levels that help differentiating between poor and excellent quality in relation to each criterion.

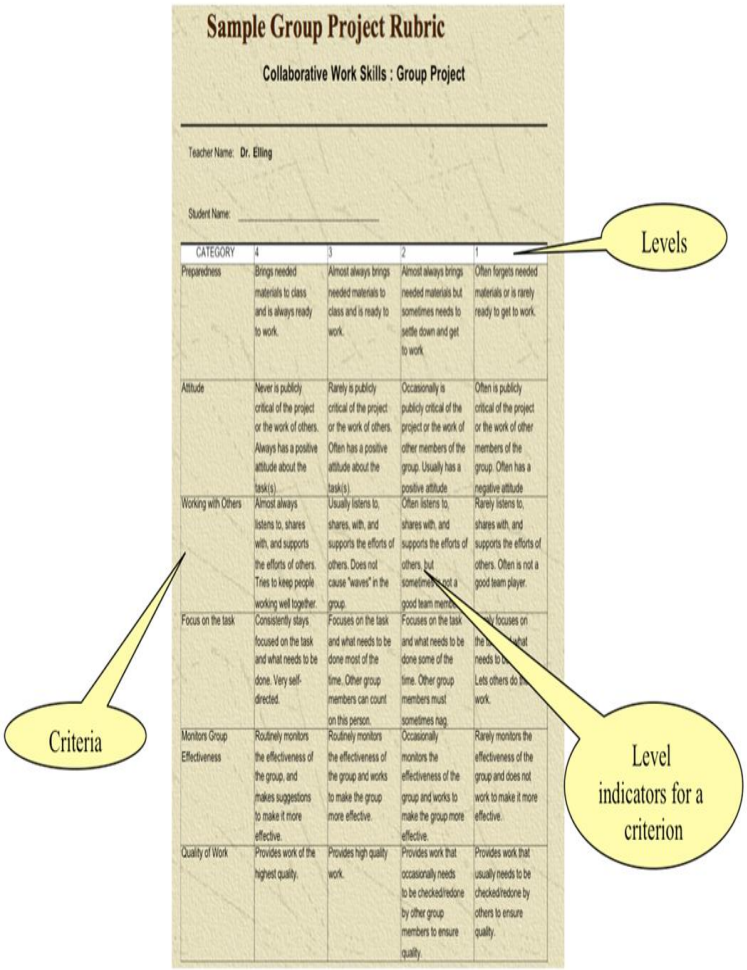

Figure 8: An example of rubric for peer assessment[32]

Teachers, working in the arts and humanities field, might complain that rubrics are mostly used in well-defined knowledge domains. This [32] clearly shows that rubrics are also applicable in very different domains: Above, we also stressed that it is critical to "prepare" students to be involved in a peer assessment exercise. In the following research [33] the authors help students to be involved in peer assessment by adding a lot of structure.

Below, you see the rubric used by [34]. This rubric was used to evaluate the quality of an abstract that a student had to write in relation to a research article. But when using the rubric, they also presented guiding questions; such as: 'What was good about your peers' work?' or 'What would you change in your peers' work? 'Other strategies require students to discuss the criteria in pairs and to decide together as to the adequacy of a quality level.

Table 2. Scoring Rubric to Measure the Quality of the Product

Main category	Subcategory	Good abstract		Average abstract		Poor abstract	
Situating the study	Intention/focus	The intention or focus of this study is specific and clearly explained in the first paragraph	10	The intention or focus of this study is rather vague	5	The intention or focus of this study is not described	0
	Problem statement	The context of the problem is clearly described	10	The context of the problem is not clearly described	5	There is no or a minimal description of the problem statement given	0
	Consistency	The intention or focus in combination with the problem statement forms a logical whole	10	The intention or focus of the study does not sufficiently reflect the problem	5	The intention or focus of the study and the problem are independent of each other	0
Content of the abstract	Methodology	The methodology is clearly explained and includes all details about setting	10	The methodology is rather vague and includes only limited details about setting	5	There is no or a minimal description of the methodology given	0
	Results	The main results of the study are concisely described and summarized	10	Not all the results of the study are described or too extensively discussed	5	The results are not summarized or are not addressed	0
	Limitations/suggestions for further research	The abstract refers briefly to the limitations of the studies and opportunities for future research	5	Little or no relevant limitations or suggestions are described in the abstract	2	No limitations or suggestions are described in the abstract	0
Finishing	Structure	Clear structure in line with the rules of an abstract	10	Unclear structure of the abstract	5	No structure	0
	Language	The abstract contains no grammatical errors and written in a smooth writing style	10	The abstract contains some grammatical errors. Insufficient attention was paid to the writing style	5	The abstract contains many grammatical errors. No attention paid to the writing style	0
	Word length	The length of the abstract corresponds to the agreed number of words	5	The length of the abstract is either just not long enough either slightly too long	2	The length of the abstract was not taken into account	0
General		The abstract shows that much time and attention was devoted to the task, leaving little or no modifications needed	20	The abstract shows that time and attention was devoted to the task, but there is still quite a lot of adjustments are necessary	10	The abstract shows that too little time and effort is spent on the task	0
TOTAL			100				

Figure 9: A rubric for measuring the quality of a product [29]

A perfect way to introduce students to rubrics, is involving them in the actual design of a rubric. This will make them aware of quality criteria, of levels in quality and the nature of indicators needed to describe different quality levels. In many ways this has more than one beneficial effect on learning.

In this study [35] students developed their own rubrics in the context of English language learning. The positive impact is linked better student understanding about what "quality" is, a more concrete understanding of what is qualified as good, better, best etc.

E. Collaborative Learning

Collaborative learning is considered as one of the most successful interactive learning interventions in higher education. Its an educational approach in learning involving students group to solve a problem at hand [36] . According to [37] it's an act where all involved members chat themselves socially and naturally that promotes learning.

Smith [38] and Macgregor [39] proposed number of assumptions to collaborative learning like:

a) Learning is an active process,
b) Learning requires a challenge that opens the door for the learner to actively engage his/her peers.
c) By exposing learners to varied opinions visible benefits accrue.
d) Learning flourishes in a social environment where healthy and productive conversation between learners takes place.

In a collaborative learning setting, exchanges of diverse ideas among participants take place. They can put their points and can have constructive criticism of other's ideas too. This lets everyone to be actively engaged in the communication. Regardless of the specific approach taken the goal is same: to shift learning from a teacher-centered to a student-centered model.[36]
There are number of benefits of Collaborative learning as given by [40]

- Engagement in subject specific discussions
- working cooperatively
- Develop effective teamwork and skills
- Assimilate multiple views to deepen knowledge and promote critical thinking
- Fostering individual accountability
- Develop independent learning strategies

In [41] various issues that arises because of group work and solutions to mitigate them presented by architecture professors and their undergraduate students.

When looking at the impact of working in groups where some students get roles versus groups without roles, the results are clear. The level of knowledge construction is significantly higher when working in the former groups.

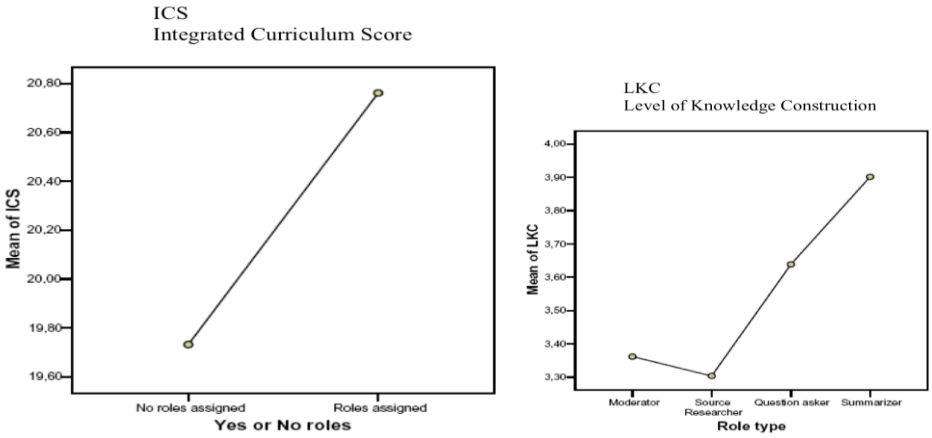

Figure 9: Performance comparison: with and without role [43]

Another way of structuring collaborative work is to presenting scripts to students[43] Armin et al. [43] proposed two types of scripts: epistemic scripts and collaboration scripts

Epistemic scripts reflect steps professionals follow to reach a certain knowledge goal. The collaborative activity is based on the interaction of students taking the different roles while tackling a problem, task, case. Some of the examples are in research, product development, nursing, education.

Collaboration scripts also known as social scripts are geared to generic collaboration roles (moderator, summarizer, question asker, ...) or context specific roles. The students are being assigned one of these roles (or rotating roles) while solving a case, problem, task, situation. Examples of this:law, engineering, medical, corporate etc.

In this [44] the two key authors in the collaborative learning research domain - Johnson & Johnson - link the value of collaborative learning to the theoretical framework of social interdependence. This study [45] exemplifies the large number of studies pointing at the significant positive impact of assigning roles to students in a collaborative learning set up.

Looking at the technological dimension, a basic solution to share documents, projects, ... online in a group is to use [46]. These are Google Drive.Podio, TitanPad, ShowDocument, Thinkbinder.

Further most Learning Management Systems (LMS) incorporate a discussion group, Forum or Wiki solution[47]. If you lack this kind of environment, there are also freely available forum solutions, you can also refer[48].

Peer Tutoring

Peer tutoring is an interactive learning technique where student act as tutors. Group or pair of students can be formed with a mix of higher performing and lower performing student. The performance level can be judged on the basis of academic, social, behavioral, functional, or even social skills[49][50].

There are number of reasons for adopting peer tutoring as an interactive learning technique in higher educations. Some of them are mentioned below51][52][53]

But, also the right-hand graph below is interesting. It shows that students with some roles learn more than others (integrated level of knowledge construction = amount of use of what has been learned).

- •Popular and widely used practice proven by research.
- •Students receive one-to-one assistance
- •Increase response level of students
- •Improves academic and social development of students
- •Increases student engagement and self-confidence.

There are number of models used for peer tutoring. Here discussion of some of the models are presented:

Classwide Peer Tutoring (CWPT): The class is divided into groups of two to five students. Any student can play the role of either tutor/tutee or both. Various activities related to peer tutoring are organized twice or more times a week with participation of whole class. The entire class participates in structured peer tutoring activities two or more times per week for approximately 30 minutes[54]. The students pairing or groups can be changed and even activities can be changed.

Cross-age Peer Tutoring: As the name suggests, the pairing or old and young student is done. The older student serves as the tutor and the younger student is the tutee.

Peer Assisted Learning Strategies (PALS): In this model a pairing of students who are at the same skill level is done. The idea is to seek help from peer in teaching or in review[55]. Tutor cards, Cue cards, having tutoring steps may be provided to help students remember PALS steps [56] The students roles are rotated at differing times.

Reciprocal Peer Tutoring (RPT): In this type of peer tutoring, role of tutor and tutee are reversed during each session. Often, higher performing students are paired with lower performing students. Preparation of instructional material and monitoring the performance of their peer lies on the students themselves.

Same-age Peer Tutoring: Peers with age difference no more than 1 or 2 years are paired. Along with age difference, students having similar abilities or levels is also considered when pairing student. Role reversal is also allowed in case students belong to

differing levels. A lower performer can question to higher performer. In this case answers should be provided to the lower performer student [57].

In paper [58] shiozawa et al. discussed about a peer tutoring implementation, supported by an experimental evaluation study. In the paper [59] emphasized study of tutor, rather than tutee experiences within problem-based learning. He also stated that socialization of tutor improves management and communication skills.
As explained earlier, tutors don't teach new content. They help processing newly acquired content. [60] applied a systematic application of peer tutoring in a first-year introductory course educational science at Ghent University. Many teachers question whether working with peer tutoring will affect the quality of overall teaching. After reading this [61] they can reassure that peer tutoring is non-inferior:
On the technological dimension, since peer tutoring is part of the collaborative learning approaches, it can build on the tools discussed earlier in collaborative learning. Nevertheless, some tools seem to have been developed with peer tutoring in mind.

III. CONCLUSION

The paper has reviewed several professional development interactive instructional activities that are expected to boost higher education professionals to support education development in university teachers. The techniques discussed in the paper are evidence-based and have as such proven to be effective and efficient in higher education settings. The author along with number of colleagues have used the discussed interactive learning-based activities in classroom with students of engineering, MCA and MBA and surely and an improvement in the learning skills of students was visible. Author also assume that the reader of this paper will get benefit from the techniques and will achieve a better learning engagement of students in classrooms and laboratories.

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