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Intrinsic Deficiencies of Lectures as a Teaching Method

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A B S T R A C T

Lectures were, still are and seem to remain a dominant form of teaching, despite an increased research and use of other methods of teaching and leverage of technology aimed at improving teaching results and efficiency. Learning, as the result of a lecture, greatly depends on the subject, the competence and abilities of the lecturer as well as on other transient causes. However, lectures also have some intrinsic deficiencies as a teaching method pertinent to their very nature. In order to fully understand the teaching value of lectures and their role and proper use in educational systems, their deficiencies have been studied in a theoretical analysis from the perspective of cognitive learning theories. Fifteen deficiencies have been identified and clustered in three categories based on root causes of deficiencies: synchronicity problems, time constraint and individual student abilities, needs and knowledge. These findings can be used to adjust expected learning outcomes of lectures, to properly (re)design lecture content and process and to design other learning and teaching activities that would compensate and complement lectures. Recommendations are given on replacing and amending lectures with other instructional methods, amending lectures in the course of delivery with additional content and tools and complementing lectures after delivery with content, tools and activities. Suggestions on the use of information technology that could substitute, reduce or eliminate at least some of the deficiencies are made. Lecture captures seem to be valuable supplement for live lectures compensating in all three categories of deficiencies. Suggestions and directions for further research are given.

***Key words**: live lectures, lecture disadvantages, lecture capture*

Introduction

Lectures represent the dominant method of teaching in formal education and in the major part of non-formal educational activities. They are identified with the higher education system for centuries and indeed carry majority of instructional effort. Their aim is not merely to deliver information but predominantly to teach the audience. For the purpose of this analysis a lecture is defined as an oral, continuous, in most part one-way presentation intended to teach the audience of multiple students who possess lesser knowledge of the subject than the instructor.

Lectures as teaching method were used already in the Middle Ages and were performed as reading by instructor from an original document to students who took their own notes. With the invention of printing press and technical ability to produce large number of identical documents first ideas that lectures can be replaced by some other methods of learning appeared. The same expectations were raised with other inventions like film[1], television[2], personal computers and, recently, Internet.

Despite high expectations, none of the technologies was accepted in formal education in significant extent and lectures have not been replaced by any other method in significant amount. In addition, research suggests that lectures alone are not sufficient to achieve expected teaching impact and desired learning outcomes[3] especially considering increased demand for continuous education[4]. However, new teaching methods penetrate slowly and with resistance both on sides of teachers and students[5] and lectures are still important method of teaching[6].

Consequently, it can be expected that lectures will remain for quite some time the predominant method of teaching, especially in formal education.

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TABLE 1
COMPARISON OF EFFECTIVENESS OF LECTURES AND OTHER TEACHING METHODS IN TRANSMITTING INFORMATION TO STUDENTS[8]

Teaching method	Lectures are less effective	No significant difference	Lectures are more effective
Personalized instructions	20	17	8
Discussion	18	54	22
Reading & independent study	10	21	9
Enquiry (eg projects)	6	6	3
Other (audio, TV, CAL)	27	57	20

Source: Bligh: What's the use of lectures?[8]

TABLE 2
COMPARISON OF LECTURES AND OTHER THOUGHT PROMOTION METHODS[8]

Teaching method	Lectures are less effective	No significant difference	Lectures are more effective
Discussion	29	1	2
Reading & independent study	1	3	1
Enquiry	5	1	1
Other	12	17	0

Source: Bligh: What's the use of lectures?[8]

Lecture captures, the video recordings of live lectures, are gaining in popularity and are being published by leading universities worldwide. However, since they are based on live lectures they share some of their properties.

It is often assumed that the result of lecturing exclusively depends from student: his abilities and effort and that the lecturer's role is merely to deliver information. This belief is wrong and it has been shown that the quality of the learning result of a lecture substantially depends on the competence, ability and momentary performance of the lecturer[7]. However, lectures as an instructional tool are not a perfect mean for achieving goals they are intended for. They have some deficiencies that are independent of the subject, the lecturer and the moment. Their cause is in the very nature of a lecture, they are intrinsic to the lecture as a tool.

The research has shown that lectures are as effective as other instructional methods in transmitting information to students[8], as shown in Table 1.

Furthermore, lectures are, in particular, inefficient in »promotion of thought«: teaching students to think, as shown in Table 2. In order to do so, students need to be placed in situations where they have to think on their own[8].

The principal advantage of lectures is the presence of experienced, skilled, motivated teacher who will try to engage and motivate students for the subject. The opportunity to observe and provoke reactions of students as well as to assess their comprehension of the lecture enables the lecturer to adjust the direction and timing of the lecture for the purpose of achieving the maximum learning result in the audience. Such effect and result is very difficult if not impossible to achieve with any other teaching tool. Perhaps in the future computer based tools (CBT) might be able to achieve this at least to some extent. While assessing knowledge by computers is already being used, understanding emotions and reactions of the audience is still an exclusive privilege of human beings.

In order to yield expected and required results, every educational process needs to be carefully designed and based on confirmed theoretical research of human learning experimentally verified in practice. Therefore Lectures are no exemption and need to be analyzed from the perspective of learning theories, their deficiencies have to be identified and root causes discovered. The result of such analysis could be used to properly define expected outcomes of lectures, appropriately place them in the overall educational process and adequately supplement them with other learning activities and resources. Lecture shortcomings and inadequacies could be thus avoided or compensated for.

Methods

Lectures are a teaching instrument. As such they should serve the ultimate goal of helping students to acquire new knowledge. In order to be effective, they should be aligned with the way humans learn, which is the field of study of learning theories.

There is a multitude of theories and they are usually grouped in paradigms representing different, although not necessarily opposing, views on the learning as a process. This theoretical analysis of lectures is based on cognitive learning theories.

Cognitive learning theories are best researched and elaborated paradigm with extensive body of knowledge well supported by experimental research.

In brief, cognitive approach to learning considers it to be an active process of acquisition of new knowledge by developing mental constructs within the framework of existing constructs (prior knowledge) or broadening them. The locus of control of the process is within the learner himself.

Results

In this work, based on the related research and learning theories, lectures have been analyzed in order to determine to which extent are they in compliance with learning process as defined by theories of learning. Fifteen deficiencies that diminish or prevent learning have been identified.

Student's ability and fitness to attend the lecture

The first prerequisite that is associated with lectures is student's ability and fitness to attend. Among most frequent reasons student mention for not visiting lectures are assignments they have to complete for other subjects and conflicts with other obligations. This is clearly recognized in the literature[9–12].

Another factor in this group is student's physical condition. Good health is indisputable prerequisite for quality learning. Although most of the research has been conducted on animals, researchers have proved that sickness reduces ability to learn and believe that this is an intentional mechanism which along with lethargy, depression, disconcentration, sleepiness, and reduced nutrition are organism's evolved strategy facilitating the fight against illness[13]. Evidence has been gathered showing that even mild, chronic conditions like allergic rhinitis can significantly impair learning[14].

A decade ago it was debated whether amount of sleep has any significant influence on the learning results[15]. Recent research has shown that young people are able to compensate to some extent the sleep deprivation so after only four hours of sleep they do not demonstrate significant difference in reproduction of what they've learned[16], or if their previous knowledge is tested[17]. However, the results for the age groups over 22 are much worse[18] and in a research on the effects of the lack of sleep 83.6% students have reported problems following lectures[19]. Today there seems to be an agreement that lack of sleep results in incoordination of attention, problems in decision making, complex and creative thinking and it is believed that amount and quality of sleep are closely related with ability to learn and learning outcomes, success in school, declarative and procedural learning and that sleep affects memory consolidation, the reinforcing of internal connections in the memory[20].

Final component of a student's physical condition is nutrition. Amount and type of food influence the ability to learn[21]. Two periods during the day are especially affected: lectures early in the morning if breakfast was omitted and lectures after lunch if it was large and caloric. Dehydration s also important as it has immediate effect on learning ability[22].

In addition to physical conditions, emotional state of a student also influences the learning and learning outcomes[23]. Contrary to old ideologies and methods of teaching that are still practiced in some educational institutions, stress negatively influences cognitive performance[24] and thus the ability to learn[25] workspace while pleasant atmosphere in the classroom facilitates learning[22]. Research suggests emotions to be of higher significance for learning and show that negative emotions hinder ability to learn[26]. Other authors consider emotion, motivation, and cognition as equal components of learning[27].

Strong positive emotions may also negatively influence learning results. Thus it is advised that moderate positive emotions are optimal for learning[28].

The lecturer can to some extent try to create an emotionally positive atmosphere during the lecture. However, a person's emotional state is the result of complex interactions of many internal and external factors over which the lecturer has little or no influence. For example, worries, threat and insecurity, but also being in love, being struck by luck or avoiding a fatal accident strongly influence student's ability to learn yet lecturer can hardly diminish their effect. It can be summarized that there is sufficient research evidence that for optimal learning the learner has to be in good health, well rested, not hungry and not thirsty in a pleasant environment void of stress and frustration. These requirements are general and valid for any type of learning. However, they are specifically pertinent to lectures since lectures are a synchronous, scheduled event and students have only limited influence to try to achieve physical, mental and emotional fitness for and during the event.

The practical problem is that, even if a student would take all possible measures to achieve it, like athletes do for their competitions, it is very difficult to provide and achieve ideal fulfillment of those conditions for every lecture a student attends.

In addition, the environment also influences the ability to learn and in traditional lectures students and teachers have little influence over temperature, humidity, freshness of air, noise levels etc. which can have significant impact to learning ability and achievement[29].

Lecturer's fitness

Further requirement is that the very same conditions apply to the lecturer as well. In addition, a lecturer's role is to motivate students. For this to be accomplished the lecturer must possess certain personal characteristics[30,31] enthusiasm being among the most important[28]. The problem is that it is very difficult if not impossible for a lecturer to be fit to perform in every moment of every lecture.

Again, the root cause of this problem is, like with students, in the fact that lecturer cannot adjust the timing

of his lecture to his own fitness, abilities and needs, but rather it has to be vice versa.

Scalability

Ability of the lecturer to adjust the course and timing of the lecture as well as to give accents and elaborations and to leverage the opportunity for interaction with students is not the same if the audience consists of a dozen of students or of hundreds which is often the case at universities. Research suggests that small group learning is more effective in promoting both greater academic achievement and more favorable attitudes toward learning[32,33].

One of the main advantages of live lectures is interaction with audience, answering their questions. However, the number of questions that can be answered in one lecture depend on quantity of content and available time. So, the ability of a student to use advantage of live lecture by asking questions is significantly reduced in larger audiences.

Thus, lectures are not scalable. Advantages of the lecture as instructional method significantly diminishes as the audience grows, because individual differences among students knowledge, abilities and needs grow while lecturer's ability to interact with all of them reduces.

Time for processing acquired information

Working memory (WM) has limited capacity[34] and learning happens when data in working memory are consciously processed and transferred to long term memory (LTM)[35]. Thus, crucial requirement on lecture is not to overload WM and to give students sufficient time for deep-level processing of received information[36,37]. Based on empirical results[38–40] some authors suggest to make a pause after every 15 to 20 minutes of a lecture[41], while others promote 10 minutes of discussion among students after 20 minutes of lecture allowing »buffers to unload«[42]. Experiments with memorization of unrelated terms concluded that most information is lost in the first six seconds after it is presented, an effect sometimes called »trace decay«[43]. However, it was later found that forgetting is contributed even more by interference[44]. Thus, merely making a pause is not sufficient, rather new information needs to be processed and converted into a schema stored in LTM. It can be concluded that lecture should not be continuous (over periods longer than 20 minutes) but rather in short segments of information delivery interleaved with pauses for student's individual thinking and reexamining, possibly combined with discussion with other students. In a lecture there is not enough time to systematically provide all this. It could be made, but the volume of subject covered and delivered had to be multifold reduced.

Individual abilities and needs

The new information to be remembered and understood often needs to be (re)delivered several times, the number highly depending on student's individual learning style[45,46], concentration, previous knowledge[47] and cognitive capacity in general[48]. Some students need additional information or explanations. Some students need to receive information in several different ways, possibly delivered by different lecturers. Limited available time for a lecture does not accommodate these needs.

Finally, people prefer different learning styles[49,50]. There has been extensive research on learning styles which resulted in multitude of theories[51,52]. One important aspect regarding lectures is that some people learn by reading and others by listening. This has a direct consequence on the recommendations how to construct and perform effective lecture. However, in addition, some people learn by writing or by talking[53]. While writing notes is accepted and even required in many educational institutions, research has proven that one can write and actively listen in the same time only if the spoken and written words are the same[54]. If they are different, one can pay conscious attention to only one of those processes[55]. It can be concluded that a student cannot truly pay attention to the lecturer while writing notes[56 according to 57]. In practice this means that student's shouldn't be required to write anything except their own thoughts. Textual handouts roughly corresponding to lecturer's spoken text could therefore be of much use to them. They should also be provided with sufficient time (lecturer's silence) to write their own remarks. As of those who need to speak or repeat and paraphrase lecturer's words in order to learn, lectures are quite inappropriate for they neither provide time to do that nor audience to listen to it. Besides any such activity by one student would disturb learning of all others in the audience.

Prior knowledge

In order to acquire new knowledge, the existing knowledge is the crucial foundation according to several authors and substantive research. This has been recognized in most cognitive learning theories including Ausubel's assimilation theory[57,58] and cognitive load theory[59]. Researchers agree that learning cannot take place if the learner does not possess »building blocks« i.e. prior knowledge.

Although curricula as a rule define prerequisites and examinations should warrant that all students in a class do have the required minimum of prior knowledge, in practice this is true in very coarse sense in the best case. Besides failing to align students in refinements of a subject, individual differences come stronger with age and maturity differences, language mastery and person's own culture. They all play significant role in the process of learning and they can significantly differ within an audience.

The main issue is that, in general, prior to being exposed to new information and knowledge, students do not know in greater detail what prior knowledge they should posses and do not have means to verify whether they do have it.

The lecturer has no efficient means to recognize that an individual or a group in the audience is missing a significant prior knowledge and even if he did, has no time to fill it in. For the same reason, even if a student would recognize his deficiency, it could not be patched up during the lecture.

Reinforcement

New information becomes knowledge when it is consciously combined with existing knowledge, comprehended and converted in automated schemata and stored in the LTM[60]. Knowledge can then be activated and used unconsciously and automatically. In order to achieve this, extensive practice of new knowledge application is required. The greater extent of practice results in higher automation which in turn reduces WM load during acquisition of next new knowledge. Otherwise WM will be partially occupied processing recently acquired knowledge thus reducing capacity to comprehend the newest one being taught.

There is no point in continuing learning until present content is not fully acquired. Student should have a mean to verify this on his/her own.

A typical lecture teaches more than only one new concept. When this happens in short temporal proximity both retroactive and proactive interference hinder the learning process either by the old knowledge preventing to acquire the new one or by the new one corrupting already acquired knowledge[8]. It has been shown that this effect is stronger if old and new content are similar[61]. Therefore researchers suggest taking pauses and going back to recently acquired knowledge, practicing it (again) and comparing to the new (similar) content. This again would call for reiterating parts of lectures already presented and require much more time than available in lecture.

Lecture interactivity

The main advantage of the lecture as teaching instrument is supposed to be the ability to interact with the lecturer. However, this requires sufficient time, not only for all questions and answers but also it requires additional time (»silence«) allowing a student to formulate the question and later to process the answer[62,63].

Similarly, discussion among students is another important property of a live lecture[42,43] but it also requires significant time during and after the lecture.

Lecture benefits

So far drawbacks and insufficiencies have been identified. However, it is equally important to identify true, argumented benefits of lectures and their advantages over other instructional methods.

Lectures above all should provide a structure and guidance in acquiring new information and transforming it into one's knowledge. Unlike unsupervised reading, including free use of abundant resources found on Internet, lectures, similarly to reading a dedicated textbook, can provide condensed, optimized process of knowledge acquisition. It is timed and guided. Classical printed or digitized textbooks, however, provide unimodal information: written text sometimes amended with visual information: static pictures and drawings. Lectures have the ability to provide multimodal information: both written text and visual information as well as spoken words and sounds. If carefully designed and performed in accordance of accepted theories like Cognitive theory of multimedia learning[64] lectures deliver multimodal information and instruction. Actually, if combined with moving pictures, live experiments and lecturer's choreography: movements of body and hand and face gestures, lectures leverage all student's senses and simultaneous processing thus synergizing brain's potentials and achieving even higher level of acquisition, comprehension, creating of meaning and cognition.

The only other instructional tool that can compete with lectures in that respect are video documentaries. Carefully designed and produced by experienced educators and film makers, video documentaries can achieve all mentioned benefits. In addition, since they can be improved, redesigned and perfected they do not suffer from lecturer's personal transitional weaknesses possible within a single lecture. Video documentaries retain their quality over time and repeated utilization, something even the best lecturers cannot provide over the series of same lectures. Besides, video is immortal. Financially, once produced, there is no variable expense to the use of video, especially when distributed over the Internet.

Live lectures of good lecturers have additional benefit influencing directly student's engagement in knowledge acquisition process: enthusiasm of the lecturer, her emotions, passion and energy can significantly heighten student's active participation. Passiveness of students is the mayor obstacle in learning and is frequently present in unsupervised reading or attending lectures[65].

It was stressed earlier how important is existing student's knowledge in the process of cognition, as well as detailed explanations, repetitions and examples. Live lecture has the benefit of giving immediate feedback to the lecturer about the comprehension of students, even if non-verbal. According to audience's verbal and non-verbal communication the lecturer can modify planned direction of lecture in order to provide what majority of audience requires in the present moment including turning the lecture into a live discussion or some other instructional form more suitable for achieving instructional goals.

Such fulfillment of student's needs can only be outperformed by a personal teacher. Personal teacher, if well educated, experienced, motivated and devoted to the student is among the best instructional instruments. The problem is that it is not scalable and thus is not widely available to the mankind.

Summary of lecture deficiencies

The theoretical analysis performed in this work, based on accepted theories of learning backed up by related experimental research has identified a number of deficiencies of lectures as a teaching method. They are:

1. the necessity for student to have time and be able to be physically present at the certain place in a certain moment
2. physical, mental and/or emotional unfitness of the student at the time of the scheduled lecture

3. physical, mental and/or emotional unfitness of the lecturer at the time of the scheduled lecture
4. insufficient time for the student to think and rethink about the presented information
5. insufficient time for the student to formulate a question on time
6. insufficient time for all students to pose their question and for teacher to answer them all
7. insufficient time for the student to reinforce new knowledge by analyzing multiple examples and solving assignments
8. insufficient time for the lecturer to redeliver knowledge when required by cognitive process of a student and to do it in different forms
9. insufficient time for the student to write notes
10. uncertainty of students about prerequisite knowledge and inability to objectively test their prior knowledge
11. insufficient time for the student to patch up his prerequisite knowledge gaps during the lecture
12. inability of students to objectively verify if they really acquired new knowledge
13. insufficient time for students to pose questions to the lecturer, to discuss with lecturer and peers and to use networking
14. intimidation of the student to discuss and use networking
15. impossibility for students to talk during the lecture if they need to talk in order to learn

It is useful to group them by their main cause in order to provide insight in directions of possible solutions. Three major groups are proposed: synchronicity, time constraint and students' individual differences.

Synchronicity

The need for all students and the lecturer to be present physically at the same place in the same time is the root cause of problems related to participants' physical, mental and emotional readiness for learning (and teaching).

Spatial synchronicity can be overcome by some form of telepresence to the expense of losing face to face communication in much the same way as watching a TV broadcast of a concert or theatrical play is not the same as »being there« with the difference that telepresence allows for feedback.

Temporal synchronicity can only be overcome by a recording of a lecture. It can be recorded at a time when the lecturer is able to deliver her top performance and consumed by a student when she is at the top of her learning performance. The drawback is the same as for the telepresence void of the ability to receive feedback, in both directions.

Time constraints

Limited duration of a lecture neither allows students to think and rethink about what has been presented nor lecturer to repeat important parts or present them in several different ways in order to accommodate different individual student's learning styles.

It also prevents students from giving their feedback to the lecturer and formulating and asking questions as well as the lecturer to answer all of them and in detail.

During lectures this can be overcome only by significantly reducing the delivery plan of the lecture, in order to provide ample time for interaction. However, the bigger the audience, the more time is required, although the increase is less than linear since many questions repeat among students.

A possible solution could be recorded lectures since they provide the student with all the time she needs. The student can play, stop, replay and seek through the recording according to her needs and at her own tempo.

Students' individual differences

Differences in prior knowledge of students in the audience cannot be dealt with during the lecture. It is impossible to create sufficient time to accommodate this. There should be clear instructions to students what the prerequisites are, ample learning materials for students to acquire them on their own and ability to objectively verify their own knowledge, possibly in the form of a computer based test.

During the lecture, even if students had additional learning materials at their disposal, if they would use them they wouldn't be able to pay attention to the lecturer in the same time. However, it might be useful to provide students with information about terminology and other possibly missing knowledge, which could be consumed in a few seconds. Although missing a bit from the lecture students would fill the gap in their knowledge which would otherwise create unwanted cognitive load.

For larger gaps lecture captures (recordings of lectures) could be the solution since they can be paused until required knowledge is gained.

Well designed and performed lecture would be multimodal. The lecturer would deliver information using written and spoken words, drawings and photographs, moving pictures, visualizations and simulations. She would use her passion and body language to reinforce the key messages and direct students' attention.

No lecturer is perfect for every learning style. Students rarely have opportunity to choose the lecturer who suites them best. Recording lectures of different lecturers on the same topic would provide students with the ability to do so.

Discussion

In order to achieve desired learning outcomes form teaching activities, the role and expected learning out-

comes from lectures need to be defined and their deficiencies identified and be compensated for. There are three ways o do that. Lectures can be replaced by other instructional methods for achieving some specific goals. They can be amended with other instructional methods to fully accomplish some other goals. They can also be amended with content, tools and methods within the lecture as well as after the lecture in order to fortify their abilities or compensate deficiencies.

Replacing lectures with other instructional methods

Discussions, group learning, individual unsupervised and supervised learning, programmed learning and research can and should be used instead of lectures when critical thinking, creativity and teamwork are the main goals of learning as well as when individual differences among students are too big for lecturers to overcome them[8].

Amending lectures with other methods

If lectures are used, it is important to amend them with other methods in order to achieve specific results for which lectures are not suitable. Transfer and automation of knowledge require solving problems and exercising which can only be accomplished with auditory exercises and laboratory work, individual assignments and (research) projects.

It is crucial to perform precise synchronization among all those activities since otherwise their meaning is missed, potential unused and they cannot yield expected results.

Assisting lectures in the course of delivery

In order to keep students' attention on the lecturer, all measures should be taken to liberate students from transcribing lecturer's words and copying from the blackboard. This requirement clearly comes from cognitive load theory and related research. This problem could be overcome if all materials would be available beforehand to students and in printed or digital form, including preparations for the lecture, presentation materials if used, scripts and lecture notes. Thus the only note taking on the students' part would be of their own thoughts. Leverage of information and communication technology (ICT) makes it possible for the lecturer to make the last minute changes to any material dispatched to students, immediate corrections when necessary and practically free dissemination of content. In addition, students can browse, search, copy, delete and recombine content in order to customize it to their own needs much faster, easier and cheaper than ever before. Students can also immediately and limitlessly exchange their notes and comments on lectures and subjects in general. In addition, community of students is no longer limited to the local group, but is extended both to students at other schools and previous students of the same subject. As a consequence, reinforcement and transfer of knowledge would be fostered as well as group work, networking and communication skills.

In the delivery of the lecture, the lecturer should foster multimodal learning by using multimedia: pictures, graphs and videos, computer visualizations and simulations, live demonstrations and any other mean that could help students to comprehend what is being presented. Again, leverage of ICT can deliver multimodal content in novel ways compatible with learning theories.

Printed questions and answers available to students during the lecture would help students verify whether they really understand. Frequently asked questions and answers would relieve students from the feeling that they are missing something while saving lecturer's time by keeping her on the main course of the lecture. They might also encourage students to ask questions not listed.

Finally, adjusting the course of the lecture to audience's abilities and current state of mind is the most important feature of the lecture so usage of audience response systems (for example »crickets« or mobile phones) by lecturers to quickly gather the feedback from the whole audience should be embraced and encouraged.

Complementing lectures after the delivery

After a lecture has been successfully delivered, it should be complemented with consultations by the lecturer either in a live session, by e-mail or in a virtual forum.

Student discussion should be encouraged, possibly asynchronously via an Internet based virtual forum.

In situations immediacy, adjustability and omnipresence offered by asynchronous communications based on personal computers, mobile phones and Internet broaden the concept of the classroom and university.

Finally, the video recording of the lecture is the only way to overcome synchronicity problems and time constrains which cannot be solved within the framework of live lectures. The value of video recordings is not only as a substitute for missed lectures but in the ability to review parts of lectures as many times as necessary for a student to fully understand what is being said. Even further, a student can search for a recording which presents the same content but in a different way, more suitable to student's own learning style or existing knowledge.

In order to leverage the full potential of video recordings they could be freely navigable and enriched with lecture notes, links, quizzes, FAQs, student notes and other resources. This additional content should be contextually interlinked and synchronized with video.

Conclusions

Both, accepted theories of learning and experiential evidence indicate that traditional lectures should be complemented in order to deliver the desired learning outcomes. The findings of this analysis can be used to adjust expected learning outcomes of lectures, to properly

(re)design lecture content and process, to help in selecting the audience and define prerequisites for lecture attendance as well as to design other learning and teaching activities that would compensate and complement lectures. Intuitively and empirically it is expected that proper use of information technology could substitute, reduce or eliminate at least some of the deficiencies which calls for further research. The findings give arguments for this belief, indicate the direction of technology implementation and suggest a need for further research. In particular they indicate the potency of video recordings of lectures as a novel instructional method provided the recordings are enriched by other materials in a proper way.

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INHERENTNI NEDOSTACI PREDAVANJA KAO METODE POUČAVANJA

S A Ž E T A K

Predavanja su bila, još uvijek su i čini se da će ostati dominantan oblik poučavanja, unatoč povećanim istraživanjima i primjenama novih metoda poučavanja i korištenja tehnologije s ciljem unapređenja rezultata i učinkovitosti poučavanja. Učenje, kao rezultat predavanja, uvelike ovisi o temi, kompetencijama i mogućnostima predavača kao i o drugim, prolaznim čimbenicima. Međutim, predavanja imaju i neke intrinzične nedostatke kao metoda poučavanja koji proizlaze iz same prirode predavanja. Teorijskom analizom nedostataka predavanja s aspekta kognitivnih teorija učenja pokušalo se razumjeti obrazovnu vrijednost predavanja i njihovu ulogu i pravilan način primjene u obrazovnim sustavima i procesima. Identificirano je petnaest nedostataka predavanja te su grupirani u tri kategorije prema temeljnom uzroku nedostataka: problemi sinkronizma, vremensko ograničenje predavanja te individualne sposobnosti, potrebe i znanje studenta. Saznanja o nedostacima se mogu koristiti za ispravno definiranje očekivanih obrazovnih ishoda predavanja, dizajn sadržaja i procesa predavanja te dizajn drugih obrazovnih aktivnosti koje bi dopunile predavanja i kompenzirale njihove nedostatke. Izložene su preporuke kako zamijeniti i nadopuniti predavanja drugim metodama poučavanja, kako dopuniti predavanja za vrijeme izvođenja dodatnim sadržajem i alatima te kako nadograditi poučavanje nakon predavanja odgovarajućim sadržajem, alatima i aktivnostima. Predložene su informacijske tehnologije koje bi mole nadomjestiti, umanjiti ili poništiti barem neke uočene nedostatke predavanja. Snimke predavanja se čine kao vrijedan nadomjestak predavanjima u živo jer mogu kompenzirati nedostatke u sve tri kategorije. Dane su smjernice za buduća istraživanja.