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**Experiments in artificial intelligence-based educational methodology (case study presentations)**

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# Abstract

In recent years, the inter-institutional MY-X research group has operated most actively within the framework of the KJU (Kodolanyi Janos University, Hungary) on the field of educational methodology. In the presentation, principles and good practices will be demonstrated which can be used (in addition to classic primary/secondary school talent management, company, and university education) for individualized, competence-oriented teaching step-by-step. How is it possible:

1. to distinguish between the consistency of knowledge levels that appear to be the same with naive scoring systems by involving artificial intelligence in the performance evaluation, i.e., who managed to realize more "guessed" points in an exam than others?
2. to successfully integrate (provably doomed to fail) thesis writing chatGPT services into a creative process that can significantly surpass chatGPT?
3. to integrate artificial intelligence-based multilingualism and/or
4. avatar-based educational solutions into the grade/score creation processes?
5. to support any subjects/topics with the Solver-based way of thinking?
6. to support arbitrary subjects/topics by including data visualization supports that provide logging of user behaviour patterns in detail?

Some of the experiments already started before the COVID period. Even then, e-learning-based education dominated the education combining several subjects at the same time in the form of a single complex grade-giving task. The most active persons among the participants managed to appear at international conferences in 1-2 semesters, or spontaneously created group work fields in which a single group task resulted in half a dozen theses. The experiments are continuing in Germany from May with ERASMUS support. The outlined conceptual elements were not only able to complement the classical forms of talent management, but (at the cost of significant "time sacrifices") they also led to success in cases interpreted more like catch-up according to the canon (e.g., dyslexia). Of course, like perhaps no other method, this approach (following the Knuth principle) is also not suitable for all personality types of trainees - not even at the cost of significant sacrifices of the instructor's time: (where the KNUTH-principle defines a hard red line for the development of robot-teachers: knowledge/science is what can be transcribed into source code, all other human activity is art).

# Introduction

The starting sentences should already be an attack against the arbitrary opinion-based communication about complex challenges like AI: AI-based thinking can hardly be interpreted without massive practical experiences. All students and/or teachers, they will only hear/read something about AI, may never derive real conclusions! Everybody has to have experimental experiences with AI – especially with the basics of the AI. High-levelled AI-solutions (like a boxed software) do not help to understand the logics behind the AI-based world-interpretations. By the way: these expectations are/were valid for other professional domains like statistics, languages, etc. On the other hand, sport and/or artistic activities do not need to be practices them in order to become an expert (c.f. coach): e.g., about the beauty of moving human and or robot-eyes are capable of evaluating their distance to the optimum…

This article tries to present important details of experiences from more the 30 years of education concerning AI-based LEGO-systems. Namely, AI is already used and/or involved in education processes for “ages”. The systematic attention of the mass is however given since ChatGPT is available.

ChatGPT has a positive constellation: the Internet is massive present, the citizens are already contaminated through a lot of online services and the ChatGPT can not only be observed over the shoulder of other peoples, but it should really be used, and it can simply be used!

The article has following chapters: the Chapter “Backgrounds” will describe the most important historical events concerning the authors.

The Chapter “Experiences” with its 6 subchapters provides the most relevant details concerning the keywords:

1. objective performance evaluation based on anti-discrimination AI-modules
2. integration of ChatGPT into the daily teaching/learning activities (see AI-based chat-bot-development effects)
3. avoiding the multi-lingual risks and chaos-situations based on AI
4. substitution of human teachers based on AI-oriented speaking avatars
5. supporting Solver-based problem-solving as a kind of AI-based human-machine interaction challenge
6. creating robot teachers/coaches based on LOG-data and AI-LEGO-stones

The Chapter “Discussion” will try to highlight weaknesses/risks based on the till now realized experiences in a self-critical way.

The Chapter “Conclusion” presents suggestions for the life-long teacher education.

The Chapter “Future” will give a short list about the further planned actions of the authors…

# Backgrounds

A kind of chronological overview can be found in the following publication: <https://miau.my-x.hu/miau/196/My-X%20Team_A5%20fuzet_EN_jav.pdf>. This article presents the history of the Solver-based thinking. The AI as such (interpreted by the authors) can be presented for students/teachers in an experimental way using the Excel Solver-engine (or even the own Solver-based online tools: [https://miau.my-x.hu/myx-free/index\_en.php3 /](https://miau.my-x.hu/myx-free/index_en.php3%20/) [https://miau.my-x.hu/myx-free/coco/index.html /](https://miau.my-x.hu/myx-free/coco/index.html%20/) <https://miau.my-x.hu/myx-free/index_en.php3?x=e0> / <https://miau.my-x.hu/myx-free/index_en.php3?x=t0>... This chronological overview affects each other focused keywords, because the AI-based LEGO-stones are the Solver-based modules themselves. These modules are context-free, and so, they can be integrated into arbitrary projects like robot teacher (<https://miau.my-x.hu/miau2009/index_en.php3?x=e0&string=teacher>), robot historian (<https://miau.my-x.hu/miau2009/index_en.php3?x=e0&string=historian>), robot citizen (<https://miau.my-x.hu/miau2009/index_en.php3?x=e0&string=citizen>), robot coach (<https://miau.my-x.hu/miau2009/index_en.php3?x=e0&string=coach>), robot-aesthetic-expert (<https://miau.my-x.hu/miau2009/index_en.php3?x=e0&string=aesthetic>), etc.

Students (and/or employees/teachers) have the opportunity to create on robots based on real data assets and real problems having already naïve solutions/benchmarks or even having not yet any solutions.

# Experiences

The following case study-abstracts report about different long periods. The objectivity as keyword is present for 30+ years, because one of the LEGO-stones in the MY-X online tool was designed directly to the anti-discrimination problems.

The ChatGPT seems to be the youngest challenge, but the robot-writers (more: the quality assurance of human writing – c.f. academic writing skills – automated) is also a 30+ year old phenomenon for the MY-X research team.

The Babel problem is also treated for 30+ years: always based on the quality of the online translation machines.

Speaking robots are really rel. new: the first international conference was hold 2015 where our first avatar-based presentation could be streamed: <https://miau.my-x.hu/miau/209/pzsny/>

As already highlighted, the Solver-based thinking is the alpha and omega for the authors. It means that 30+ years experiences are already given – in connection with the term “similarity analysis” based on Solver-engines.

Each analysis can be seen as a LOG-based analysis if real data are available. The LOG-based analysis means however here and now, that human behaviour can be measured (see EEG, mouse activities, etc.) and based on these LOG-data, a kind of robot psychologist can be designed (as a part of the robot teachers): c.f. <https://miau.my-x.hu/miau2009/index_en.php3?x=e0&string=psycho>. Concerning the ELTE-2023-Conference about pedagogy, a special presentation will be offered with the focus of 2DM-games (<https://miau.my-x.hu/miau2009/index_en.php3?x=e0&string=2dm>).

During the 30+ years, where the experiences could be collected, there were more than 5000 students affected [own estimation based on the stored grades/scores in the particular learning management systems]. This group of students can be interpreted as a quasi representative set: they represented quasi all disciplines (engineers, economists, HR-managers, teachers, communication experts, artists, etc.). The (re)actions of the students are logged – if the entire email-communication can be seen as a kind of unstructured interview-series. The following summaries to the keywords (as subchapter’s titles) are qualitative interpretations of the ca. 100.000 email-units:

## Objectivity

The basic declaration is the evaluation of the knowledge and/or competences is (for ever till now) is subjective and absolute. It means: the evaluation is subjective because the teacher’s intuitions lead to the individual scores/grades – c.f. the question, whether the observed performances of a set of students can lead to the conclusion that every student’s performance seems to be the same is only theoretical existing – in practice there is no (KNUTH-oriented - [https://miau.my-x.hu/miau2009/index\_tki.php3?\_filterText0=\*knuth](https://miau.my-x.hu/miau2009/index_tki.php3?_filterText0=*knuth)) methodology given to support the similarity-based (relative and objective) evaluation. The evaluation is absolute, because one single individual can also be evaluated without the existence of other individuals to relativize the performances of a single individual.

On the other hand, in the background of the randomized observed sameness of the absolute/subjective performances can exist massive risks (differences): c.f. 3 students with an average score of 3 in case of 3 subjects can have following grade-sets: e.g., 1+3+5, 2+3+4, 3+3+3 – they may not always be interpreted as homogeneous sameness-oriented situations.

The AI-based performance evaluation is a kind of anti-discriminative modelling: e.g., <https://miau.my-x.hu/miau/273/Naiv_optimalizalt_verziok2.docx> (c.f. <https://miau.my-x.hu/miau/281/renitent_countries.docx>). These models make it possible to derive the numerical traps of the simple additions. The different layers of the performance can be evaluated as such, and these partial evaluations can be aggregated: but the naïve aggregation (the well-known weighted or not addition) and the KAZOHIN-aggregation (similarity analysis - <http://www.kevius.com/kazohinia/>) lead not always to the same results.

The reaction of the students and teachers concerning the KAZOHINA-oriented (similarity-based: objective and antidiscrimination-driven) evaluation is quasi monotonous:

* quasi all of them (already from high school on) are as far as contaminated with the subjectivity, that they can not change/want not to change the well-known system around them,
* they are quasi not directly capable of building objective/antidiscrimination-oriented evaluation systems,
* but quasi all persons know the risks and critical aspects of the subjective and absolute approaches…

Conclusions:

* robot-teachers / robot-psychologists can not be developed without the mathematical approximation of the objective Goodness as such (c.f. <https://miau.my-x.hu/miau2009/index.php3?x=e0&string=good>),
* the well-known “problem solving” robots do not have any approximations of the Goodness (c.f. IBM WATSON: [https://miau.my-x.hu/miau2009/index\_tki.php3?\_filterText0=\*ibm](https://miau.my-x.hu/miau2009/index_tki.php3?_filterText0=*ibm)),
* the entire social politics (incl. talent management and/or actions to homogenization of performances) can not be driven in an efficient/optimized way without log-analyses and antidiscrimination models – it means we should be capable of knowing where the border is between the self-destruction and what the mischance?! (c.f. [https://miau.my-x.hu/miau2009/index\_tki.php3?\_filterText0=\*Nagy\*Band\*](https://miau.my-x.hu/miau2009/index_tki.php3?_filterText0=*Nagy*Band*)),
* the whole society should have more and more experiences about antidiscrimination-driven modelling (at least concerning performance evaluation).

## ChatGPT

Concerning the ChatGPT-services there are a lot of own case studies available: e.g., <https://miau.my-x.hu/miau2009/index.php3?x=e0&string=chatgpt>

The ChatGPT as such catalysed worldwide reactions which can be seen as a kind of benchmark-series compared to the own experiences: e.g., <https://www.youtube.com/results?search_query=chatgpt+risks+chances>

One of the main problems is the involving or avoiding the new services into the education?! The system-theoretical approach let say: each service (c.f., abacus, pocket calculator, PC, Internet, smart phone, etc.) should always be integrated into the educational processes: the question is not the black or white approximation but the useful amount of the time being spent with the particular services…

Therefore, the strict avoidance e.g., of the smart phones in the school can not be evaluated as such (without a 24-hour-activity-plan). If the schools can ensure that students can be experiences the smart-phone-less-life than even the strict avoidance can also be a relevant decision of the society – assumed that the after/before-school life is smart-phone-oriented…

The own decision (concerning ChatGPT) is trivial: it must be involved into the education (especially into the BPROF-education and/or into the education about business informatics for future economists, but also for teachers and other experts). The argumentation for the involvement of the ChatGPT services is also trivial: we can only in frame of the education demonstrate how weak or how strong these services can be. The human text-creation can be supported through rule systems like the rules of academic writing skills. These rules are however not KNUTH-oriented rules: there could not be transformed/transferred/transcripted into source codes. It means that these rules could be operationalized – not at all: c.f. <https://miau.my-x.hu/myx-free/index.php3?x=test11> The magic of words (used for describing the rules of the AWS) can therefore not be involved into the text-creation services like ChatGPT where the next probabilistic word/letter-sequence are estimated.

The own experiences with ChatGPT (see constructing 3\*3 matrices where the column headers and the row headers declare the possible content of the appropriate cells, and/or trying to deliver argumentations (pros and cons) for a declaration – let alone impossible creation of lists about facts behind a certain declaration of the ChatGPT (which can however be innovative/new) delivered trivial results: the ChatGPT does not have any contextual Goodness, and the statistical Goodness (for completing partial sentences) do not follow any logics. This is the same critics like in case of non-interpretable neural networks e.g., for picture recognition tasks (where it is maybe to tolerate) but also for arbitrary production functions where the real ceteris paribus connections between inputs and output should be explored and represented in an understandable structure. Artificial neural networks are however not designed to such challenges.

One of the side effects of the own experiments is a classic definition about the threshold of the usefulness of educations (c.f. [https://miau.my-x.hu/miau2009/index\_tki.php3?\_filterText0=\*b%C3%BCf%C3%A9szak](https://miau.my-x.hu/miau2009/index_tki.php3?_filterText0=*b%C3%BCf%C3%A9szak)): all the courses, curricula where the particular ChatGPT services should have a diploma, are not relevant for the society (c.f. term of “büfészak” in Hungarian). Therefore, ChatGPT (as motivator, mediator, facilitator, mentor, teacher, classmate, etc.) should always be involved into the education as a mirror, as an objective evaluator: what kind of minimum performance should be achieved or more exactly what level is already good enough for a diploma.

## Babel

The word of Babel is a sign for the language-chaos, which makes the magic of words more relevant. The phenomenon of the magic of words is existing in mathematics too (c.f. [https://miau.my-x.hu/miau2009/index\_tki.php3?\_filterText0=\*t%C3%A1jsz%C3%B3l%C3%A1s](https://miau.my-x.hu/miau2009/index_tki.php3?_filterText0=*t%C3%A1jsz%C3%B3l%C3%A1s)). The communication between human beings was/is and will always be a guessing process and not a technical issue where the sent message/content and received message must always be the same. This guessing process produces mostly misunderstandings, and this is a kind of waste of the resources, but this intuitive challenge (the communication on the field of the magic of words) leads to associations being innovative and therefore relevant for the entire society.

Therefore, the reduction of the language-chaos does not seem to be a trivial need, but concerning the own personal development it is relevant to be capable of understanding which text version can be translated into the other languages (here and now – it means based on the recent technical level) without relevant content changes/losses (c.f. <https://miau.my-x.hu/miau2009/index.php3?x=e0&string=20q> / <https://miau.my-x.hu/miau2009/index.php3?x=e0&string=renitent>).

It is not trivial how to speak/write so that the given online translator services produce the same message based on a circular translation process involving more and more languages. Therefore, it is relevant to highlight that the AI-based education (where the AI services as such are the recent translation capabilities) makes possible and even expected at the same time) can support the increasing the most conscious text creation competences without needing to be involved in team activities. So, the robot-teacher-specification has to integrate this challenge/requirement/feature.

## Avatars

The creation of avatars (where the AI-based speaking robots substitute the teacher’s presence on demand) is a special bubble in this AI-oriented education universe: the human teachers have to plan appropriate dramaturgies (mostly in parallel ways for different needs: see personality-driven/tailored education based on log-data - below). The teachers can not always be present, and students are not always motivated enough to be present in predetermined presentations, therefore the avatars make possible the time-decoupling. The avatar-based logic in the education could be transferred to the conference-organisation and it would be necessary to organize conferences where the presentations are prepared in advance and they can be downloaded on demand: c.f. [https://miau.my-x.hu/miau2009/index\_tki.php3?\_filterText0=\*-mp4-](https://miau.my-x.hu/miau2009/index_tki.php3?_filterText0=*-mp4-)

The own avatar-oriented experiments can be followed here: <https://miau.my-x.hu/miau2009/index.php3?x=e0&string=quilt>

The acceptance of the avatars by students is quite different: there are students whose socialization expects the human-human interaction – even after a COVID-phase (or even due to it). Other personalities accept at once the on-demand-logic of the avatar-driven education. The blended solutions can however be accepted in case of both groups.

## Solver

To learn all potential problem-solving-possibilities is a hard and time-consuming job: therefore, it is worth to have the competence of the problem translation for e.g., Solver-engines. This is a kind of being capable of questioning like in case of ChatGPT, where the sophisticated (detailed enough, keyword-driven) questions lead to better AI-answers too.

The Solver-based thinking (c.f. <https://miau.my-x.hu/miau2009/index.php3?x=e0&string=solver>) has quasi an unlimited application spectrum (from gamification like sudoku via interpretation of chemical equations to complex price/performance analyses or even forecasting models).

The most valuable employees are who can involve AI into the business process and who do not try to solve a problem as human expert but who is capable of letting solve the problem through the appropriate agents/engines.

Therefore, the conclusion is simple and trivial as always: we need to teach/to support the competence where the students will be able to translate problems and to cooperate with other LEGO-components (even they are e.g., AI-based).

The Solver-oriented translation challenges and the Babel-chaos-minimizing competencies are strong connected to each other – let alone, the communication with the ChatGPT, where the own human needs should be translated into sentences where the keywords are capable of trigger the ChatGPT…

## Log-data

The LOG-data-driven AI-projects mean that the students will be observed (with their acceptance) and the data about the computer using (e.g., mouse, keyboard, EEG, emotion, eye-tracking, etc.) make possible to create robot-psychologists as a part of the robot-teachers.

The following projects are already closed:

* EEG: <https://miau.my-x.hu/miau2009/index.php3?x=e0&string=eeg>
* Eye-tracking/Emotion-detection: <http://miau.my-x.hu/miau/233/maugli_emotions_v1.docx>
* Mouse: <https://miau.my-x.hu/miau2009/index.php3?x=e0&string=2dm>
* Complex analyses: <https://miau.my-x.hu/miau/288/2d_3d_complex_study.docx>

The log-data-analyses based on AI is a neighboured project to the above-presented objectivity projects because both of them try to understand the observed persons. The objectivity-oriented analyses focus on the performances without the way leading to them, during the log-data-oriented observations try to detect the ways/circumstances leading to the performances.

The acceptance of the observations (c.f. being observed) is a special part of these activities: <https://miau.my-x.hu/miau2009/index.php3?x=e0&string=being.observed>).

The performances and the inner and environmental circumstances make possible the exploring of the rational behaviours (incl. self-destructions, mischances): e.g., <https://miau.my-x.hu/miau2009/index.php3?x=e0&string=%C3%B6nsors>

The conclusion is simple and trivial: the learning/teaching activities can not be understood deep enough without appropriate data assets and AI-based models. In future, the robot-teachers have to identify the mental/content-level-oriented/etc. learning problems and they have to deliver appropriate reactions (in content and/or method): e.g., <https://miau.my-x.hu/miau/138/graf/>

# Discussion

The AI-based teaching/learning universe is a new environment for students and/or teachers – in different way pro person. Therefore, it is always necessary to have such personalities/socialization types, who are less compatible with the new LEGO-components and their combinations and vice versa.

The AI-based LEGO-elements are chances and no enforced medicines. The human actors have the responsibility to search for optimal parameter combinations, where in future, these searching activities will also be supportable through AI, if we follow the KNUTH’s principle: [https://miau.my-x.hu/miau2009/index\_tki.php3?\_filterText0=\*knuth](https://miau.my-x.hu/miau2009/index_tki.php3?_filterText0=*knuth)

# Conclusion

AI-driven support systems/modules should be involved into the daily education business – but in a responsible way! The most relevant step is the education of the teachers because this step can be realized promptly and without the appropriate preconditioned teachers, students can not be lead effectively and efficiently. Students can learn from each other, but the teachers have to be capable of learning from the students too. For the strategic impulses, responsible are always the teachers and the system of the teacher education!

# Future

Each institution should collect online tutorials and appropriate trainers, mentors for supporting a step-by-step education of teachers for using the AI-oriented LEGO-components.

The teachers evaluation (student’s satisfaction surveys) should focus directly on the AI-based teaching in case of each teachers – in a tailored form.

# References

…see in text…