

DISTANT HANDS-ON APPROACH IN ICT TEACHING FOR ADULTS

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ABSTRACT

During Covid-19 pandemic ICT industry grew rapidly. This situation led to some positive aspects for teaching. Such technologies as virtual conference and classroom software made distant learning more possible than ever before. Faculty of Education, Psychology and Art of University of Latvia started further education courses in ICT for in-service teachers in June 2022. There were 3 pilot groups with 54 participants in total. A new program was developed according to the new curriculum of ICT subject in schools. Using the previously collected experience of distant teaching during Covid-19 pandemic, it was decided to use *Microsoft Teams*, *Moodle* and open source software to provide courses. Courses consisted of practical usage and teaching methodology of office, programming, media, computer graphics and web site development.

The purpose of this research was to find out the effectiveness of distant learning using the hands-on approach. The analysis of literature presented expectations of good results for adult teaching in subjects not demanding special equipment or laboratories. It was found that it was economy of resources such as time, money and special classrooms.

The target group was in-service teachers with pedagogical experience, learning to become teachers of ICT. Both sides: teachers and participants were warned to use the computer with at least 2 screens and a good quality internet connection. Teaching materials and assessments were placed in the *Moodle* system. Practices and trainings were recorded for later usage and study. Results of participants' questionnaire showed that courses were highly rated. In addition, results of final report assessment were highly rated by teachers. As conclusion, it revealed that distant teaching for adults in the ICT field using hands-on approach has a high value from the viewpoint of participants and teachers and it is useful to provide next courses using the approach described in this research.

Keywords: *adult teaching, distant teaching, hands-on, ICT teaching, educational courses, course planning, ICT education*

Introduction

Social restrictions during Covid-19 pandemic (year 2020 – 2022) raised a new viewpoint on technologies in education. It was not possible to meet people in the classroom

or working place depending on the restriction level in the appropriate field. This brought the society all around the world to a new understanding of Industry 4.0.

Industry 4.0 consists of PLC (Programmable Logic Controllers), IoT (Internet of Things), CPS (Cyber Physical Systems) (Vaidya et al., 2018). The focus point of Industry 4.0 is the paradigm change in information and logistics, which promotes decentralization, individualization and increase of network services (Gabriel & Pessl, 2016). It is different in every sector and type of company that affects the overall planning strategy (Ortt et al., 2020). Such descriptors of system were there before, but social restrictions pushed growth of technology usage rapidly. According to theory of unequal impact (Ortt et al., 2020), education was one of the fields with a big impact of technologies as there was evidence that readiness of technologies is close to serving distant teaching. It is very important to continue working in education even if it is partly available instead of waiting for “better times”.

The purpose of this research was to find out the effectiveness of distant learning ICT (Information and Communication Technology) courses for adults using the hands-on approach.

To reach the purpose, the following tasks were set:

- To analyse literature regarding teaching adults online
- To provide the ICT course for in-service teachers (participants)
- To provide student questionnaire regarding the quality of the course
- To evaluate final assessments of participants.

Hypothesis: a high quality ICT course output is possible working online using the hands-on approach.

A research question: how to organize effective ICT courses for adults?

Theoretical Framework

Since 2017, the competence-based learning “Skola 2030” has been introduced in Latvia (Ministry of Education and Science, 2019). The new curriculum consists of different topics of computer science, covering participants from the first grade instead of the fifth, and placing more focus on programming, design and computer graphics (Regulations Regarding the State Basic Education, 2020). Such an approach led to creating a new course for in-service and becoming ICT teachers focusing on the new trends. Modern learning becomes fragmented, more focused and cheaper, not losing the quality using online platforms (Condruz Bacescu, 2018). Online Learning may maximize university resources and increase university reach and accessibility without decreasing the quality of education; focus on participants’ perception (Ramirez II et al., 2021). According to previous findings on providing similar courses, several pieces of advice were introduced. Both sides: teachers and participants were warned to use the computer with at least two screens and a good quality internet connection. Teaching materials and assessments were placed in the Moodle system. There were three groups of participants in total. Due to time schedule, Group 1 and Group 2 became pilot groups without the possibility to learn

using video recordings. Group 3 became the main group, with a possibility to make time schedule more comfortable and record online videos for individual training. The usage of training videos improve learning outcomes through individual autonomy, competence and experience (Boldisevica & Dislere, 2015). Creating a new program in teaching ICT using ICT Digital Visual Literacy (DVL) appears to be very important because it is double layered: a teaching program for teachers and methodology for further implementation in schools. DVL includes topics as Visual Culture, Art and Design, Vision Science, Computer Graphics and Visualization and Image Economy (Spalter & van Dam, 2008) and they were implemented in new ICT course as well. In other terms, DVL is critical evaluation of visual materials, decision making based on data and ideas and effective visual communication using computers (Ervine, 2016). Value-oriented and positive approach in distance learning is very important; rising high expectations for participants stimulates high performance (Niari et al., 2016). For the presented ICT course, there was an approach to define basic purpose to give a very practical hands-on online opportunity to understand programming and to start programming together with teacher as the most difficult topic, improving skills to use office and computer graphics software, connecting understanding and real practice. Beauchamp & Kennewell (2010) highlights interactivity functions of ICT learning, pointing out access, navigation, engagement, elaboration, monitoring and self-regulation. *Microsoft Excel 365* was used to plan studies and improve collaboration of teachers. *Microsoft Teams* software was used to run online sessions, share online experience and materials, also to improve planning of lectures. Elements of online learner-centred courses are: stratified grouping, learner produced artefacts, problem-based assignments, discussion boards, one-to-one mentoring online, grading comments, video recording (Chernosky et al., 2021). *Moodle* and *Microsoft Teams* were used to make the course learner-centred. Academic support is important as well as emotional and psychological support throughout all the process of study (Fotiadou et al., 2017). There was a possibility to ask any questions during the online sessions and to solve problems together. Personal priorities of digital transformation should be set to pursue own goals (Suleiman et al., 2022). To transform the ICT course, priorities were set to provide maximum lessons using the hands-on approach and implement more upcoming new topics of programming, computer graphics and design, less pointing (but not losing) methodology of teaching applied software.

The course was designed according to Jawaral's (2019) spiral: planning, laying down performance indicators, risk mitigation, prototyping, testing and re-designing, doing process endlessly till eternity. As Group 1 and Group 2 worked synchronously, the first design round was based on previous courses provided by organizers and teachers. The second round was teaching Group 1 and Group 2, the third round: Group 3 and the fourth round will be prepared for future courses after results of this research. The best practices for the online course design: providing a course overview, designing clearly stated, appropriate, and measurable outcomes, support the learning needs of diverse learners, providing accessible online courses, multiple ways to engage learners, designing inclusive instructions, developing a consistent user interface experience (Lewis, 2021).

Empirical studies related to the adoption of existing digital learning platforms and systems in different learning contexts should focus on the evaluation of the integration process (Christopoulos & Sprangers, 2021). Pattern Oriented Software Architecture drives educational technologies: it is the use of GoalsPattern, ProcessPattern and ContentPattern (Chimalakonda & Nori, 2021).

Methodology

The target group of participants was in-service teachers with pedagogical experience, ($n = 54$), with participation of 84.6% female which is close to average rate of European Union (Eurostat, 2022) (see Figure 1). 35% of participants had 20 or more years of pedagogical experience, but 24% of participants had 11 to 20 years of experience. Overall 80 % of participants had 6 or more years of experience. For evaluation, it was a good point to measure the quality of this course from the perspective of experienced experts. The average pedagogical experience differs in groups, but no connection was found between the experience and participants' opinion regarding the course.

The questionnaire with closed and semi-closed answers was used to measure results of providing the course. Focusing on pattern-based measuring, it was possible in the course to divide questions in groups and see some course providing issues if necessary.

Objectives regarding the data collection were met:

- *Microsoft Forms* was used for collecting data as a safe, in-company technical tool
- *Microsoft Excel* was used for data string to integer recalculation
- *IBM SPSS 22* was used for descriptive statistics and T-Test for measuring attitudes towards course between 3 groups
- Group 1 and Group 2 were pilot groups starting courses in one time, without video recording and with technical time planning restrictions

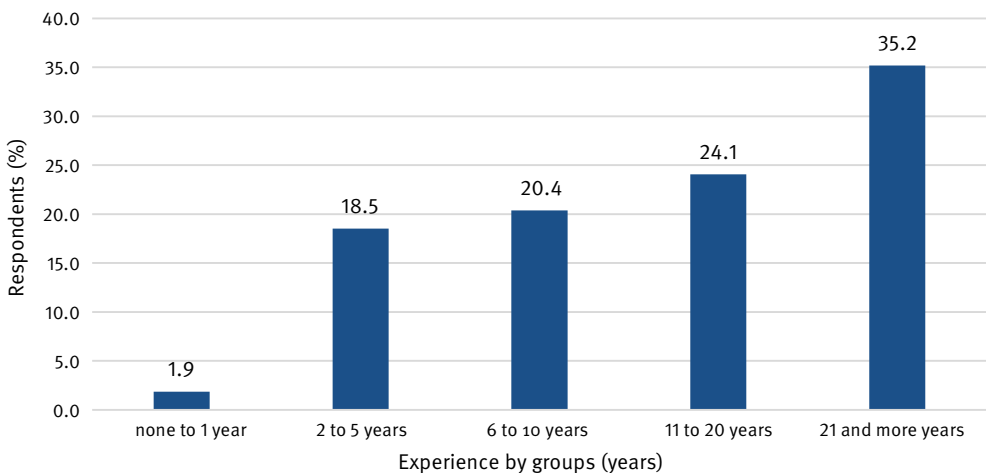


Figure 1 Pedagogical experience of participants ($n = 54$)

Note: there is difference in steps of experience years

Table 1. Criteria to evaluate course results of participants

Task	Topic	Weighted value (% of final mark)
Task1	Development of project calculation, printing and presentation documents	15
Task2	Photo animation development	15
Task3	Developing a simple animation or game	15
Task4	Development and implementation of the website sketch	10
Task5	Program using loops and conditions	10
Task6	Product development with the use of external data source, functions and arrays	15
Final	Final report of the course portfolio made using the applied documentation with an oral presentation – 20%	20

- Group 3 was the main group with no restrictions regarding time planning, video recording etc.
- After Group 1 and Group 2 graduated, the survey data was analysed
- Regarding results, there were changes introduced for the main Group 3
- All data was collected after the graduation of the course
- 4 point Likert scale was used to describe participants' attitudes towards results of the course
- The value of all variables was recorded 1 to 4 points – all categories were highly evaluated by participants
- Evaluation by teachers was according to Table 1, showing division of topics included

Results

According to three-pattern division by Chimalakonda & Nori (2021) questions regarding overall course questions were analysed, separating them from questions regarding the personal performance of teachers. As data show (see Table 2), there was no significant difference between results (comparing each group to group, and Group 1 & 2 to Group 3). Mean value in every answer for every group varies from 3.41 to 3.80. Such a high value means that in participants' opinion the course was provided in a very high quality. Group 3 was slightly more critical towards results of the course. Special focus on the answer "Quality of online lessons": results show that there might be some participants less satisfied with such a form of learning.

There were advice questions regarding further planning of the course (see Figure 2). Open answers of advice from participants were collected, recoded and grouped by topics. Answers of Group 1 & Group 2 were used to prepare Group 3 studies. The most popular advice pertained to time management (5 answers), lesson recording (4 answers), improvement of the topic sequence (3 answers) and less intensive content (3 answers).

Table 2. Student evaluation regarding overall course progress and quality, comparison by each group separately

	Group	Teaching materials	Teaching methods	Quality of online lessons	Usability of knowledge and skills for future	Overall course content	Course management process
1	Mean (total: 3.61)	3.75	3.5	3.4	3.6	3.6	3.8
	<i>n</i>	20	20	20	20	20	20
	Std. Deviation	0.444	0.688	0.598	0.598	0.681	0.523
2	Mean (total: 3.67)	3.76	3.59	3.65	3.69	3.63	3.69
	<i>n</i>	17	17	17	16	16	16
	Std. Deviation	0.437	0.507	0.493	0.602	0.619	0.602
3	Mean (total: 3.50)	3.59	3.41	3.41	3.35	3.47	3.76
	<i>n</i>	17	17	17	17	17	17
	Std. Deviation	0.618	0.618	0.87	0.606	0.514	0.437
Total	Mean (total: 3.59)	3.7	3.5	3.48	3.55	3.57	3.75
	<i>n</i>	54	54	54	53	53	53
	Std. Deviation	0.5	0.607	0.666	0.607	0.605	0.515

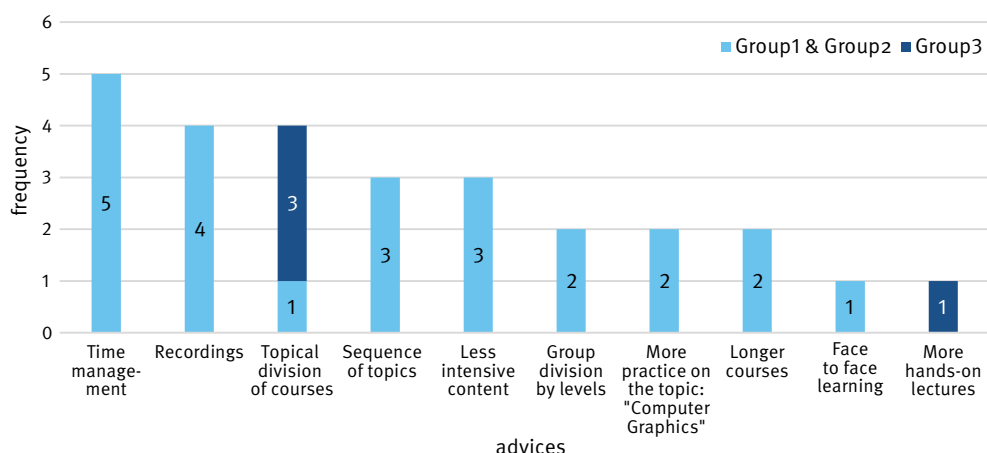


Figure 2 Student open answer advice regarding course management, comparison between pilot groups and main group

Group 1 & Group 2 had 23 pieces of advice (11.5 advice for each group average). There were changes made in planning for Group 3, also video recording for hands-on tasks was introduced. The time planning was less dense, programming topics were sorted by programming language starting from lower levels of education to provide in. As a result, Group 3 had less additional advice (4 pieces of advice), mainly focused on the division of the course topics by the level of education they are delivered. This means that Group 3 was satisfied after introducing changes made after piloting the course. Changes in the course planning and video recording did not impact results of participants' attitude positively (see Figure 2).

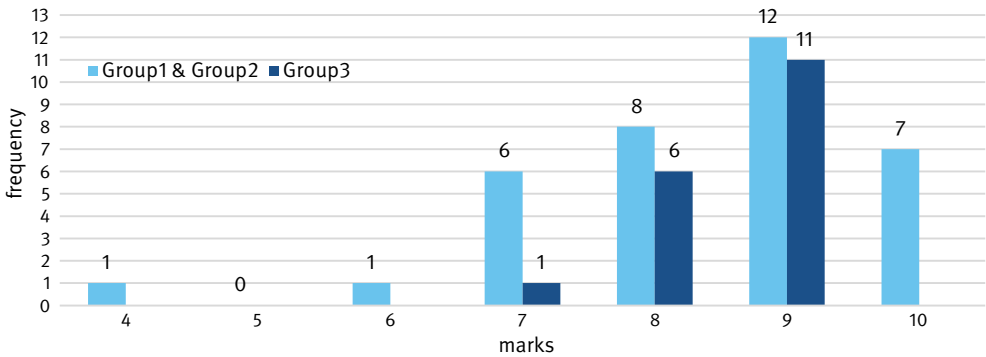


Figure 3 Final marks of participants, passed the exam ($n = 53$), pilot groups compared to main group

At the end of the course, the final exam took place on-line. After the exam, final marks were counted including marks of practical tasks and the examination mark. Final marks were compared between pilot groups and the main group (see Figure 3).

Teachers rated teaching results with an average final mark for Group 1 and Group 2 8.4 from 10 points. Teachers rated teaching results with an average final mark for Group 3 8.56 from 10 points. Group 3 had better average results. Group 3 had less dispersed results, cutting off extremely low and extremely high results. Looking at final results, they also are very good. Much more focus can be made looking at the number of participants who had most of marks: 7 till 10. Still the pilot groups had higher results but more dispersed. The main group was more homogenous, but without excellent results at all. Such results may point to the fact that the evaluation was a little lower from the main group because of harder studies.

Discussion

As the results of questionnaire and evaluation are high, it can be concluded that methods of building this course were succeed from viewpoint of participants and teachers. Theoretical aspects describing course building process and structure, interactive work, quick response and practising were useful and helpful.

Results confirm that up-to-date online platforms and distant learning returns good output if course is planned respecting diversity of participant, Digital Visual Literacy principles, value-oriented and positive approach, hands-on working using appropriate hardware. Course structure must be pattern oriented to use experience and achievements of building similar courses, and to have opportunity to measure results in different courses with similar structure. Course must be evaluated by participants and teachers and updated after every graduation. Content and evaluation must be value and goal oriented.

This research is not analysing the attitude of participants regarding participants' previous experience in teaching ICT, as it is a fact that some teachers attended the course

to improve their knowledge but some came to learn teaching ICT from the “scratch”. In addition, this research did not focus on funding sources of courses, as sources differed for some of groups. As teachers were with a great teaching experience, results are more valuable. From participants’ advice, it is clear that it would be better to separate participants by the level of teaching programming. On the other hand, the teacher never knows which level of education the teacher will work after a few years. Besides, education must be universal covering primary and lower secondary school. Results of this course leads to creating a new course for advanced programming teachers using approach of building present course. Such a step will give an opportunity for basic level teachers to make the next step, as well as an opportunity for experienced teachers to improve their competence using a much more modern approach to methodology of teaching programming in secondary school.

Pattern oriented inner structure and developing process of the course helped to build each topic using common architecture and external approach of building new course will help to create new courses in future, based on patterns, experience and results from course described in this research.

Strengths of this study is experience of teachers to create and provide similar courses. Groups of participants were relatively homogenous: they all were teachers with good ability to learn, evaluate and reflect. Weak point of this study are small number of participants: so overall results of the research might be expected as piloting results and further data must be collected from next groups to improve the course.

This study is limited to ICT subject and participants with basic level of ICT usage.

Conclusions

Theoretical background comes from analysing literature: Industry 4.0 differs on each branch. In education, it took a big share during Covid-19 pandemic (years 2020–2022). Main agents of Industry 4.0 are usable to introduce distant education for adults. ICT education is special because technologies to learn are basically used to provide the course. The course should be student-oriented, planned and improved in a loop. The quality should be measured to improve the management, process and results of the course.

The course was provided to three separate groups, which were divided in pilot and the main group.

A participants’ questionnaire was used to assess the quality of the course. Results of participants’ questionnaire showed that the course was highly rated. In addition, results of the final assessment were highly rated by teachers.

Teachers provided the final assessment of participants. The main Group (Group 3) showed higher rate of final assessment, higher rating for the course management process, produced less advice for future, but rated less higher all other aspects of the course than pilot groups.

The above discussed led to the conclusion that distant teaching for adults in the ICT field using the hands-on approach has high value from the viewpoint of participants

and teachers and it is useful to provide next courses using the approach described in this research. Technical and course providing advice are usable for further courses. The aim set for the research has been reached and the hypothesis “high quality ICT course output is possible working online using the hands-on approach” is confirmed from the side of participants and teachers.

A research question: how to organize effective ICT courses for adults has been answered:

- course should be built according to aim set up at the very beginning of planning,
- workplace needs to be set up before learning for both: participant and teacher for comfortable work environment,
- hands-on practise is very useful in teaching ICT
- quality measurements need to be done for evaluation and improvement of the course
- Time management and topical sequence need to be focused during the course.

Additional background questions might be introduced in questionnaire to get more information about previous experience of participant in ICT usage. Next step of this research is to try to provide similar courses to mixed audience or to prepare new course using principles achieved during this study to measure if method is useful more widely.

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