Project grants for strengthening STEM subjects in vocational education and training – 2021

Project title: Increased quality in teaching of STEM subjects in vocational education through the use of Virtual Reality
Application number: 0072538
Applicant name: Michael Lund-Larsen
Applicant position: Other
Administrating institution: Aarhus Business College

Grant period in years:	3
Total requested budget:	3.609.400
Received from administrating institution:	
Received from other sources:	
Applied from other sources:	

Applicant

Personal Information

Full name:	Michael Lund-Larsen	**E-mail address:**	mll@aabc.dk
Phone number:		**Position:**	Other
Gender:	Male	**Nationality:**	Danish
Date of birth:	1953-06-06	**Country of residence:**	Denmark
ORCID:			

Educational Information

Degree:	Other
Please specify:	Programmer
Institution:	Niels Brock Copenhagen Business College
Date of degree:	02/06/1974

Current Institution

Institution:	Aarhus Business College
Department / Institute:	The National Knowledge Centre of E-learning
Division:	
Institution phone no:	+ 45 89 36 33 33
City:	Viby J
Country:	Denmark

Experience

Short CV

Work experience:

Programmer at the Data Center (CCI) 1973-1980

Education Secretary, Head of PROSA's Education Department, 1980-1993

Head of Education Aarhus Business College, 1993-1998

Development Manager Development Department @ventures at Aarhus Business College, 1998-

Center Manager eVidenCenter, The National Knowledge Center for e-learning, 2007-

Summary of relevant experience

Head of the development department at Aarhus Business College and the Danish National Knowledge Center for e-learning. Competences within management, IT development, dissemination, fundraising, strategy and use of IT in pedagogical contexts. Project manager of large IT pedagogical projects.

Previous and Current Grants from NNF

All applications submitted to NNF this calendar year

Application number	Project title	Grant period	Amount (DKK)	Main or co-applicant	Share of grant in %	Brief description of relation to current application

Have you received grants from NNF within last five years, as main or co-applicant

No

Co-applicants

Co-applicants

Please invite co-applicants in the **Invitations** menu on the left.

Co-applicant Description

Institution

Administrating Institution

Institution name:	Aarhus Business College
Department / Institute:	The Danish National Knowledge Centre of e-learning (eVidenCenter)
Division:	
Phone no:	89 36 33 33
Address:	Sønderhøj 28
City:	Viby J
Country:	Denmark
Webpage:	http://evidencenterinfo.dk/
CVR:	48 57 06 58

Supplementary Contact Person

Supplementary contact person full name:	Daniella Tasic Hansen
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Supplementary contact person phone number:	+45 25413510

Proposal

Project Information

Project title

Increased quality in teaching of STEM subjects in vocational education through the use of Virtual Reality

Brief project description

This project aims to explore the possibilities of strengthening the interest in and the quality of teaching STEM subjects at the vocational education and training (EUD and EUX) through virtual reality (VR), including developing hands-on learning tools and methods that can be implemented into the teaching at the schools.

The project will take the shape of a pilot project that will test and develop an actual VR learning tool for a selected number of courses (5) at a number of selected test schools (5-10). The aim however, is that the learning tools and methods developed throughout the project can be developed to and spread across all vocational education and training institutions (EUD and EUX) in Denmark, in order to add value and quality to the teaching of STEM subjects across multiple causes and in many years to come.

Project description

The main focus of the project is to test and develop a VR learning tool that can strengthen the interest in and the quality of teaching STEM subjects at the vocational education and training (EUD and EUX). Through VR, it is the aim to help students improve their STEM competencies while also creating a clear link between education and work by simulating real life cases in the virtual space. To secure an authentic experience, the project will look to develop scenarios in collaboration with relevant companies.

The virtual learning tools are intended as a new inspiring addition to the courses that

will *not* replace but assist and add value to the existing teaching.

In order to test the effect of VR across a grand scale of vocational education and training courses the project will create 5 different scenarios for 5 very different courses, touching disciplines such as electricians, machinist and math. In this way, the project can better test the effect of VR in each discipline and customize the learning tool for better implementation.

The following schools have already confirmed their participation in the project:

- Mercantec
- Erhvervsskolerne Aars
- Viden Djurs
- Aarhus Business College
- UCRS (Uddannelsescenter Ringkøbing Skjern)

Furthermore, we are in dialog with a number of other schools, who have shown interest in participating in the project either directly or through knowledge-sharing and communication.

Learning method / learning materials

The training programme for teachers will be built on previous experiences using Virtual Reality (se more at https://aabc.dk/eux-business-og-eud-business/nyheder/virtual-reality-skal-goere-elever-klar-til-virkeligheden-2/ and http://evidencenterinfo.dk/wp-content/uploads/2019/10/vr_undervisning-1.mp4) on vocational schools and a it-didactic framework based on the the eDidactic Consideration Model, a widely used Danish IT didactic model (originally developed for vocational education): http://edidaktik.evidencenter.dk/default.html

The "Conversational Framework" by Diana Laurriliard (Laurillard, D (2012). Teaching as a Design Science, ch. 11, Routledge)) will also be used in teacher training to represent and focus on a series of iterative exchanges; between learner and teacher, learner and their peers, two levels of concepts and practices. The framework will be included to support the development of course plans.

Furthermore the approach described in SIM-standards http://www.sosu-simulation.dk/SIM-Standarder (in particular standards 3,4 and 6) will be used as inspiration for the integration of the VR scenarios in the classroom.

The teachers will work with their own course in the training programme and reflect upon which subject matter and pedagogical aims they want to achieve with the use of VR. A big part of the training programme will also consist of collaboration between all teachers involved where they exchange and collaborate on ideas and pedagogical approaches with each other, both onsite and in a Virtual Learning environment (Moodle).

eVidenCenter will facilitate the training programme.

Preset pedagogical goals for the scenarios and courses are that they have to be:

- student engaging and motivating
- strengthen cooperation between students
- connect theory and practice
- revolve around authentic scenarios

Outlines for scenarios in VR, course plans and teacher guides will be developed by the teachers with support from eVidenCenter and all partners involved.

Furthermore the teachers will learn about the possibilities with VR (through practical exercises) and the technical and practical details. Kanda, CopenX and eVidenCenter will facilitate this part of the training programme.

The VR Platform

The VR platform will be developed in collaboration between eVidenCenter, CopenX, the selected education institutions and Kanda.

Kanda is a VR software development company, who has great expertise in creating VR platforms in a number of projects with organizations such as Novo Nordisk, Coop, Siemens, Aarhus Business College, and VIden Djurs.

The VR learning tool will consist of 5 different scenarios (1 per course) that will combine STEM subjects with real life case scenarios that will help to showcase the importance of STEM competences as well as inspire and motivate the students. Each scenario will be developed based on the knowledge and insights from the selected schools as well as other educational institutions, relevant companies etc. The platform will then be tested and customized based on the learnings of the test periods in the courses. The platform will be developed in stages (first 3 scenarios, then 2), in order to optimize both learnings and ressources.

Learning materials

This project will result in several learning materials that can be used broadly: Course plans that describe the use of the scenarios in different subjects and teacher guides to assist teachers implementing the scenarios in their teaching. The course plans will be shared outside the project group when finished.

Furthermore a more general guide with tips and practical advice will sum up results from the testing period. This guide will also supply technical guides on how to use the scenarios and equipment. The guide will be publicly shared for other schools and teachers to use.

Course plans and teachers guide

Teacher guides and course plans for integrating the scenarios in teaching will be developed by the teachers in the project.

The teachers will produce 1-3 different detailed course plans that include the use of the scenarios in different manners with regard to learning objects, target groups, learning approaches, feedback and evaluation and organisation of the course (onsite and/or Blended Learning).In this way teachers and schools can use the scenarios in different ways.

Each with a teacher guide attached for other teachers to use and be inspired by. The teacher guide will contain advice on how to use the course plans, possibilities for differentiation and points of attention.

General guide

The course plans and teacher guides will be shared with a more general guide that includes findings from testing combined with a practical guide for other teachers who want to use the scenarios in their teaching. The general guide will also contain practical og technical guidance in using the VR-platform and VR equipment.

Target group

a. Teachers in vocational schools
b. Student in vocational schools
c. Schools and teachers outside the project group

Exploratory questions:

· What changes do students and teachers experience that the VR project has brought about in relation to the students' motivation for teaching in the subject where VR teaching has been implemented?

· What changes do students and teachers experience that the VR project has brought about in relation to the students' learning and acquisition of academic material in the subject where VR teaching has been implemented?

· What changes do students and teachers experience that the VR project has brought about in relation to the students' understanding of technology and motivation for working with STEM?

· What challenges and potentials do the teachers who have been in the project experience?

The evaluation consists of both qualitative and quantitative data material in order to both be able to measure a documented change and gain nuanced insights into how the project has gone with a focus on the above evaluation questions. The evaluation specifically consists of the following data sources:

- A questionnaire survey conducted among all students participating in the project. The purpose of the questionnaire survey is to measure whether the project has created the desired changes based on the survey questions. This is achieved by doing a survey among all the project's students, where a questionnaire is sent out to all the students shortly after each testing of scenarios.

- A group interview with all participating teachers (expected 10 teachers). The purpose of the group interview is partly to get the teachers' assessment of what changes the project has brought about for the students and themselves, and partly to gain deeper insight into why and how the project has created the change that has taken place. In addition, the group interview will shed light on the challenges and potentials the teachers have experienced in the project. The interview may be conducted. virtual.

- Focus group interview with selected students (approx. 5 per test). Students are interviewed in immediate continuation of testing and observation.

- Observations of testing the Virtual Reality scenarios in teaching. An observation guide is prepared which is used for observation during all tests.

Data from observations and interviews are used to support the development and adaptations of scenarios and courses during the project period,

The results of the evaluation are disseminated in a short format, eg as a presentation or a short report. The content will be figures that document the changes that the project has created supplemented with qualitative insights.

Finally, a number of points of attention will be described, which can be used in the development of the project after the first project period and form the basis for a general guide to the use of VR scenarios in teaching.

Time schedule

2022 1st half year
Preparatory activities:
Project establishment, organization of courses for teachers, start-up on competence development of courses with VR (including input for scenarios in VR)

2022 2nd half year
Development of course descriptions with scenarios, development of scenarios in VR.
Continuous development of practical guide

2023 1st half year
Testing of VR scenarios in teaching on selected teams, adjustment and adaptations of platform and scenarios, observation of teaching.
Continuous development of practical guide

2023 2nd half year
Testing of VR scenarios in the teaching of selected teams, adjustment and adaptations of platform and scenario, evaluation of activities.
Continuous development of practical guide

 2024 1st half year
Adjustment of teacher guides, scenarios and final report.

2024 2 half year
Completion of practical guide and dissemination of results and learning materials.

For further details view detailed budget, appendix 1.

Project organization

eVidenCenter will be responsible for the overall management for the project.

The project however, will be split into two parts, *the educational part* and *the technical part*.

1. The educational part will be managed by **eVidensCenter,** which include coordination with schools, development of learning methods & teaching guides, and facilitation of communication & knowledge-sharing.
2. The technical part will be managed by **CopenX**, which includes coordination with the developer, purchase of equipment, training of teachers, and technical support

Dissemination of key learnings

First step - Sharing af learnings and insights

Based on the evaluation, key learnings and insights from the project will be shared to both test-schools and other relevant schools, whitin vocational education and training. This will be spread through eVidenCenter as well as through CopenX' strong network of digital learning and as a showcase at the annual conference about Digital Learning, *Digital Læringsdag*. We will also reach out to the Ministry for Children and Education for broader distribution. Furthermore we will apply for the materials to be shared on EMU Danmarks læringsportal (https://emu.dk/eud)

Step two - Development of a license-based model

In order to expand the reach and impact of the learning tools developed throughout the project, a license-based business model will be developed, by which vocational education and training schools (EUD and EUX) can license the learning tool at a fair price. This will help streamline the onboarding, training of teachers, and implementation of the learning tool, while also securing a solid economic foundation to keep the VR platform sustainable in the future.

Step three - Development of further scenarios

Based on the learnings and insights of the project, the project-partners will look to develop new scenarios for new courses in collaboration with relevant schools and companies. This will widen the impact of the projects and hopefully create positive effects for teachers and students throughout all vocational education and training schools (EUD and EUX) in Denmark.

Uploads

Literature references

The "Conversational Framework" (Laurillard, D (2012). Teaching as a Design Science, ch. 11, Routledge)

Category

Educational and teaching resources

Sub-category

Youth (upper secondary education or vocational education and training)

Requested Budget

Project Period

Requested project start date:	01/02/2022
Requested project end date:	31/12/2024
Requested project period in full years:	3

Requested Budget

Total requested budget (DKK):	3.609.400
Total project cost (DKK):	3.609.400

Supplementary information

For further detail see Appendix 1

Requested Budget Details

Year 1

Budgetpost	Description	Value (DKK)
Salary - main applicant	More details in Appendix 1	334.400
Salary - consultant	More details in Appendix 1	228.000
Salary - substitute	More details in Appendix 1	377.150
Subcontractor cost	More details in Appendix 1	750.000
Travel	More details in Appendix 1	20.000
Equipment	More details in Appendix 1	324.000
		2.033.550

Year 2

Budgetpost	Description	Value (DKK)
Salary - main applicant	More details in Appendix 1	241.300
Salary - consultant	More details in Appendix 1	142.500
Salary - substitute	More details in Appendix 1	377.150
Subcontractor cost	More details in Appendix 1	500.000
Travel	More details in Appendix 1	20.000
Direct administrative expenses	More details in Appendix 1	10.000
		1.290.950

Year 3

Budgetpost	Description	Value (DKK)
Salary - main applicant	More details in Appendix 1	104.500

Salary - consultant	More details in Appendix 1	76.000
Salary - substitute	More details in Appendix 1	79.400
Travel	More details in Appendix 1	20.000
Direct administrative expenses	More details in Appendix 1	5.000
		284.900

Additional Contributions for the Project

Received from the administering institution (DKK):
Received from other sources (DKK):
Applied for from other funding sources (DKK):

Information for additional contributions

Approved Budget

Granted amount (DKK): 3.609.400

Approved budget breakdown

Year 1

Budgetpost	Description	Value (DKK)
Salary - main applicant	Herunder: - Overordnet projektledelse = 130 timer - Projekt-assistent = 65 timer - Udvikling af kompetenceudviklingsforløb og materialer = 125 timer - Undervisning/facilitering/ vejledning = 125 timer - Etablering af virtuelt læringsrum og tilrettelæggelse af forløb = 50 timer - Udvikling af interviewguides til elever og lærere, fokusgruppeinterview = 10 timer - Udvikling af spørgeramme til elever, spørgeskemaundersøgelse = 10 timer - Udvikling af observationspunkter = 7 timer - Udvikling af generel praktisk guide = 52 timer I alt = 574 timer * 397 DKK Statens standardtimesats for erhvervsuddannelsesområdet	227.878

Budgetpost	Description	Value (DKK)
	anvendes.	
Salary - consultant	Herunder: - Projektledelse vedr. udvikling af VR-scenarier = 60 timer - Udvikling af koncept samt rådgivning vedr. udvikling af VR-scenarier = 120 timer - Teknisk onboarding og undervisning i VR-platformen = 50 timer - Udvikling af generel praktisk guide = 15 timer I alt = 245 timer * 950 DKK	232.750
Salary - substitute	Herunder: - Kompetenceudvikling, udvikling af undervisningsforløb samt lærervejledning for 2 lærere per skole = 790 timer i alt - Deltagelse i fællesmøder og interview = 160 timer i alt I alt = 950 timer * 397 DKK	377.150
Subcontractor cost	Herunder: - Udvikling af VR-træningsscenarier og licenser (Kanda) for 5 scenarier i alt og license til hele perioden	750.000
Travel	Herunder: - Rejseomkostninger ifm. teknisk onboarding & undervisning - kursusdag for undervisere på erhvervsskoler (rejse for 2 personer til Jylland / Fyn). - Booking af lokaler til kursusforløb. - Rejseomkostninger ifm. fællesmøder (rejse for 3 personer til Jylland / Fyn).	20.000
Equipment	Herunder: - VR-udstyr (VR-headset 5400 DKK. pr. stk) 50 stk i alt + 10 ekstra til evt. defekt)	324.000
Direct administrative expenses	Herunder: personaleadministration, administration af løn og indkøb, regnskabsføring, finansiel rapportering, revision mv., der er direkte relateret til det ansøgte projekts forankring.	101.772
		2.033.550

Year 2

Budgetpost	Description	Value (DKK)
	Herunder: - Overordnet projektledelse = 80 timer -	

Salary - main applicant	Projekt-assistent = 40 timer - Udvikling af kompetenceudviklingsforløb og materialer = 45 timer - Undervisning/facilitering/vejledning = 45 timer - Etablering af virtuelt læringsrum og tilrettelæggelse af forløb = 25 timer - Udvikling af generel praktisk guide = 50 timer - Observation af afprøvning, prototype = 35 timer - Observation af afprøvning, endelig = 35 timer - Fokusgruppeinterview med elever = 10 timer - Fokusgruppeinterview med lærere = 6 timer - Afrapportering = 75 timer I alt = 446 timer * 397 DKK	177.062
Salary - consultant	Herunder: - Projektledelse vedr. udvikling af VR-scenarier = 45 timer - Udvikling af koncept samt rådgivning vedr. udvikling af VR-scenarier = 65 timer - Teknisk onboarding og undervisning i VR-platformen = 30 timer - Udvikling af generel praktisk guide = 10 I alt = 150 timer * 950 DKK	142.500
Salary - substitute	Herunder: - Kompetenceudvikling, udvikling af undervisningsforløb samt lærervejledning for 2 lærere per skole = 200 timer i alt - Afprøvningsaktiviteter og tilpasning (på to hold), 2 lærere per skole = 600 timer i alt - Deltagelse i fællesmøder og interview = 150 timer i alt I alt = 950 timer * 397 DKK	377.150
Subcontractor cost	Herunder: - Udvikling af VR-træningsscenarier og licenser (Kanda) for 5 scenarier i alt og license til hele perioden	500.000
Travel	Herunder: - Rejseomkostninger ifm. teknisk onboarding & undervisning - teknisk support til testforløb i undervisningen (rejse for 1 personer * 10 i hele landet) - Rejseomkostninger ifm.	20.000

Budgetpost	Description	Value (DKK)
	interview med undervisere & elever (1 person * 5 i hele landet) - Rejseomkostninger ifm. fællesmøder (rejse for 3 personer til Jylland/Fyn)	
Operating expenses	Herunder: - Licenser og drift af virtuelt læringsrum	10.000
Direct administrative expenses	Herunder: personaleadministration, administration af løn og indkøb, regnskabsføring, finansiel rapportering, revision mv., der er direkte relateret til det ansøgte projekts forankring.	64.238
		1.290.950

Year 3

Budgetpost	Description	Value (DKK)
Salary - main applicant	Herunder: - Overordnet projektledelse = 40 timer - Projekt-assistent = 20 timer - Udvikling af kompetenceudviklingsforløb og materialer = 50 timer - Undervisning/facilitering/ vejledning = 50 timer - Drift af virtuelt læringsrum og tilrettelæggelse af forløb = 25 timer - Afrapportering = 30 timer I alt = 215 timer * 397 DKK	85.355
Salary - consultant	Herunder: - Projektledelse vedr. udvikling af VR-scenarier = 20 timer - Udvikling af koncept samt rådgivning vedr. udvikling af VR-scenarier = 20 timer - Teknisk onboarding og undervisning i VR-platformen = 30 timer - Udvikling af generel praktisk guide = 15 I alt = 85 timer * 950 DKK	80.750
Salary - substitute	Herunder: - Afprøvningsaktiviteter og tilpasning (på to hold), 2 lærere per skole = 200 timer i alt I alt = 200 timer * 397 DKK	79.400
Travel	Herunder: - Rejseomkostninger ifm. teknisk onboarding & undervisning - teknisk support til testforløb i undervisningen (rejse for 1 personer * 5-10 i hele	20.000

	landet) - Rejseomkostninger ifm. kommunikation & udbredelse af projektet (deltagelse i møder, konferencer etc. i hele landet)	
Operating expenses	Herunder: - Licenser og drift af virtuelt læringsrum	5.000
Direct administrative expenses	Herunder: personaleadministration, administration af løn og indkøb, regnskabsføring, finansiel rapportering, revision mv., der er direkte relateret til det ansøgte projekts forankring.	14.395
		284.900

Applicants comments on applied budget

Budgettet er nu opdateret med alle projektrelaterede aktiviteter samt statens standardtimesats for erhvervsuddannelser på kr. 397 for Main applicant.
Desuden er budgetpost til Direct administrative expenses opdateret, ligesom der er indsat en post til Operating expenses.
Vi håber, vi hermed har besvaret fondens spørgsmål tilfredsstillende.

Appendices

I hereby certify that the Main Applicant is employed or holds a position of trust at the administrating institution.

I hereby certify that the Main Applicant is responsible for the project applied for.