

A photograph of a woman with blonde hair and glasses sitting in a yellow chair. She is wearing a white jacket over a blue and black patterned top and blue jeans. She is smiling and looking towards the right. Another woman with short blonde hair and glasses, wearing a black cardigan over a blue shirt, is standing next to her, holding a white device connected to a coiled white cable. The background is a wall with a red and white floral pattern. A blue circular graphic is in the top left corner.

Essi  
Heimovaara-  
Kotonen  
(ed.)

Smart  
Home

a social, technological and  
virtual learning and  
development environment

Smart Home

ESSI HEIMOVAARA-KOTONEN (ED.)

# Smart Home

A SOCIAL, TECHNOLOGICAL AND VIRTUAL LEARNING AND  
DEVELOPMENT ENVIRONMENT



JYVÄSKYLÄN AMMATTIKORKEAKOULU  
JAMK UNIVERSITY OF APPLIED SCIENCES

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Essi Heimovaara-Kotonen (ed.)

SMART HOME

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# ABSTRACT

Essi Heimovaara-Kotonen (eds.)

Smart Home. A Social, Technological and Virtual Learning and Development Environment.

All people have the right to good housing regardless of their age or functional capacity. The objective of the Smart Home environment is to present solutions that enable accessible and safe housing and promote meaningful assistance and life at home.

The goal of building the Smart Home environment was to find a user-oriented, comprehensive solution for the client, which maintains the client's own control over his or her home environment. The Smart Home was also built to serve the development of new service concepts and operating models that were even more cost-effective and client-oriented than before in co-operation with working life parties.

The Smart Home serves as a centre of expertise for the well-being sector, sharing information about intelligent and innovative living, increasing general knowledge of solutions that make living easier, and clearing away prejudice related to special groups. From the point of view of developing learning, the facility offers opportunities for students and professionals alike to learn about different technological solutions and their applications in practical work in a home-like environment, for example when providing assistance.

The Smart Home offers solutions that can be tested by the users and applied individually to make daily life, living at home, and assistance in different situations easier. The Smart Home learning and development environment is used to strengthen the competence of future professionals in the health care sector in utilising technology to support living and nursing.

Keywords: accessible housing, user oriented solutions, new service concepts, special groups, living at home, learning and development environment

# INTRODUCTION

For several years now, JAMK University of Applied Sciences (later JAMK) has carried out projects and applied research on the theme of accessibility. The initial spark for the research and development of the theme of accessibility was the co-operation with Lund University in the so-called Housing Enabler and Accessible home -projects and later in the research on perceived housing with the University of Heidelberg. JAMK's role in the cooperation was to test in practice the product concepts created based on the basic research done at the university, and to develop them further applying the methods of applied research. The co-operation projects produced and tested usable accessibility models and projects for the construction of homes for the elderly.

The thought of creating and building a new kind of model environment for accessible and safe living started from the discussions between JAMK personnel and the working life partners, as well as the needs analyses in 2009. A need arose to create an environment that would make it possible to respond to the following development needs, among others: the environment creates the latest competence in research and product development as well as learning situations in connection with real working life, makes process development more efficient by utilising information and communication technology, builds an inspiring development and testing environment, offers laboratories for the research and development activities of well-being services and development facilities for service and technology companies as well as different type of facilities for purposes such as organising corporate events, and support in finding funding.

The goal was to build and pilot an accessible learning and development environment that enables the running of operations, where the environment and virtual technology enable the participants to become developers as well as producers of information. The Smart Home environment also makes it possible to develop the competence of professionals, personnel, and students. The development and strengthening of competence can be achieved by doing things yourself, following the actions of others, and by reflecting on what you do.

The Smart Home is a social, technological, and virtual learning and development environment. It is an operating environment where the users, customers, various type of experts and developers work together. With the

help of the innovations created, people are motivated and supported in taking responsibility for their own functional capacity and well-being. As a testing environment, the Smart Home is excellent for people who need different kind of service solutions for homes and living and operating in their immediate surroundings.

JAMK actively participates in the development of the region of Central Finland. The regional development work and interaction with our society are included as a key underlying theme in all strategies that guide the activities of JAMK University of Applied Sciences. As a whole, the purpose of JAMK's research, development, and innovation activities is to develop the work and business life of the region and the well-being of its inhabitants on a needs-oriented basis, and to generate entrepreneurship based on new competence. As part of JAMK's Lab environments, the Smart House offers diverse opportunities for the development of entrepreneurship and internationality, and it makes possible new ways of learning.

Eila Latvala & Kare Norvapalo



# THE SOCIAL, TECHNOLOGICAL AND VIRTUAL LEARNING AND DEVELOPMENT ENVIRONMENT SMART HOME

Toni Pekkola

The Smart Home learning and development environment makes it possible to investigate the usability and applicability of existing or new technological solutions for the use of customers and well-being service companies. The facility was built to serve the development of new operating models in co-operation with educational institutions, research institutions, and companies. The Smart Home facility and the activities established therein will in the future serve to develop technological applications and cost-effective service concepts. However, the goal was not to build a facility only, but a centre of expertise; a context for activity and learning; a place that coalesces into an adaptable, technological and inclusive Living Lab that makes human activity possible. (Smart Home – A Social, Technological and Virtual Learning and Development Environment, project plan).

The Smart Home is equipped with various accessible and safe living solutions. Some have been purchased with separate funding, and some with co-operation agreements with companies. All solutions selected for the Smart Home are fully functional, and they can be used and tested in a home-like environment. The Smart Home also has parallel and sometimes overlapping solutions; the Smart Home is not an example of a home designed for a single group of customers in real life.

## THE ACCESSIBLE YARD REMAINS FREE OF SNOW AND ICE EVEN IN WINTER

The Smart Home begins at the yard, because the passage to the Smart Home through the peaceful inner courtyard of the building is accessible. The yard area has two customer parking spaces, one of which is marked as disabled parking. There is a heating system under the paving in the yard, which keeps the yard free of snow and ice in the winter and makes it easier to move around using assistive devices. Customers with impaired vision are guided to the Smart Home with the help of a sound beacon and the raised figures on the paving, which help find the right direction.

It is also possible to practice gardening in the yard. With the help of raised planters, the garden has been brought closer to the user and above the ground level.



Figure 1. Yard area (Photo: Ronan Browne)

## THERE IS AN INTERACTIVE WHITEBOARD AND AN ERGONOMIC WORKSTATION IN THE TEACHING FACILITY

In the Smart Home teaching facility, lectures can be arranged for up to some 20 people. Contrast has been taken into account in the student seating. A person with perception problems can find a light chair more easily against a dark floor. There are also fixed writing pads on the lecture chairs for both right- and left-handed people.

The teacher's workstation has a desk with electric height adjustment and a saddle chair, which help find an ergonomic working position. The computer has a touchscreen, but lecturers can also use the interactive whiteboard if they wish. It is also possible to connect a game console to the whiteboard or use it in testing the wheelchair simulator.



Figure 2. There is an interactive board in the teaching facility (Photo: Ronan Browne)

## THE LIVING ROOM SERVES AS AN ENTERTAINMENT CENTRE

There is a comprehensive electronic entertainment system in the living room of the Smart Home. You can watch films in 3D, with film theatre quality audio. In addition, people can play physically active games with game consoles regardless of their level of functional capacity.

The seats in the sofa set support the posture and balance the seating pressure. The sofa, the recliners, and the rocking chair also have removable, washable covers with hygiene protection. The active chair assists a person when he or she starts moving, and it can be also used as training equipment to promote muscular strength and balance. The waste container is also hygienic, because it operates with a motion detector.

The weather station in the living room describes the current weather with information presented in images and numbers. Assistive devices for visual impairments and simulation goggles can also be found in the living room. With them, the students can learn about the everyday life of a visually impaired person in a home-like environment. The simulation goggles can also be used to test the usability of different products.



Figure 3. A waste container operating with a motion detector is hygienic to use (Photo: Ronan Browne)

## THERE IS AN EXTINGUISHING HOOD IN THE ADJUSTABLE KITCHEN

In the Smart Home kitchen, nearly everyone can cook, because the height and distance of the cabinets and kitchen island can be adjusted electrically and they can be brought close to the user. In addition, the drying and corner cabinets have shelves that can be pulled out manually.

The extinguishing hood that communicates wirelessly with the stove and cuts off the power in dangerous situations makes the kitchen safe. The stove is an induction stove with knobs; it only heats up when an induction stove-compatible vessel of the right size is on the stove. It is also possible to prepare food in a combination oven, which includes a microwave oven, a convection oven, and a grill function. You can set down hot food straight from the oven on a surface designed for the purpose, located under the oven.



Figure 4. Adjustable kitchen cabinets and an induction stove with knobs (Photo: Ronan Browne)

The food storage solution in the Smart Home includes a fridge with drawers in two sections, and a freezer cabinet integrated into the kitchen cabinets. The dishwasher, too, is an easy-to-use model with drawers.

An illustrated cookbook written in plain language has been created for the Smart Home to make cooking easier, to be used as a support in occupational therapy, for example. Small assistive devices can be used to facilitate food preparation and eating. The height of the dinner table can be adjusted electrically, and seating comfort and ergonomics have been taken into account in the chairs for both the inhabitant and the assistant.

In the Smart Home, laundry has also been brought to the heart of the home – the kitchen. The washing machine and the dryer have been raised above floor level and brought into an area with more space to work in in more ergonomic working positions.

The kitchen has a safety floor with a friction surface, and there are sensors under the flooring that make it possible to observe if a customer leaves the room or anticipate falls.

The audiovisual modelling and recording system in the kitchen can be used for purposes such as occupational therapy, where the expert and the client receive feedback in video format on the client's process skills in preparing food, for example.

## THE ASSISTANT'S ERGONOMICS HAVE ALSO BEEN TAKEN INTO ACCOUNT IN THE BEDROOM

The bedroom has a cork-based safety floor with sensors under the flooring that make it possible to observe if the client gets up from the bed and moves into the toilet facilities, for example. The bed sensor increases the level of security: it monitors the inhabitant's movements with motion detectors, and raises an alarm if the client happens to fall off the bed.

The adjustable bed has comfort features as well as various positions for care. This ensures that elderly persons can continue using their own familiar bed, even they move into assisted living at some stage of their lives. The bed also has smart bed sensors, which allow the monitoring of pulse and breathing without attaching separate sensors on the person's body. With the sensors and the online service, the inhabitant or the care personnel receive feedback immediately in the morning on how well the inhabitant has slept the previous night. With this solution, athletes and trainers can also monitor the recovery of an athlete after a performance or training.

It is easy to eat and read in bed with the help of an adjustable bed table. The drawers of the bed table open in both directions, which makes the items in the drawers easily accessible when the client is lying down and when he or she has left the bed. For those working in bed, there is also a stand for a laptop.



Figure 5. Nursing bed and smart bed service (Photo: Toni Pekkola)

A bar to assist in getting up has been installed in the Smart Home bedroom to make getting out of bed easier. When the client moves out, the bar can easily be taken along, because it does not need to be mounted permanently.

Ergonomic assistance and moving between the bed, wheelchair, and bathroom can be accomplished easily with the help of the ceiling lift system.

Clothes are easily available with the electrically adjusted clothes rail. There are also assistive devices for dressing up and taking medication in the bedroom. Someone with a memory illness can be reminded of taking his or her medication with a special medication reminder or medication clock.



Figure 6. Electrically adjusted clothes rail (Photo: Ronan Browne)

The audio-visual modelling and recording system in the bedroom can be used in teaching situations, where the student receives feedback in video format on issues such as working positions when moving the patient.

## COLOUR CHOICES IN THE BATHROOM HELP PERCEIVE THINGS MORE CLEARLY

Different users and groups have been taken into consideration in the Smart Home bathroom. People with low vision, issues with identifying and remembering colours due to ageing, or other perception problems have been taken into account in the colour and contrast choices.

A person using a wheelchair can easily move from the bedroom into the bathroom with a ceiling lift system, which can be used to move the person to the toilet seat or into a shower chair equipped with a height adjustment function. The height of the sink can also be adjusted.





Figure 7. A support handle, a shower head holder, and a seat with a height adjustment function make showering easier (Photo: Ronan Browne)



Figure 8. The height of the sink can be adjusted, contrasts help perceive things more clearly (Photo: Ronan Browne)

Fixed handles have been installed on the bathroom walls to provide support for the elderly. Some of the handles also have a quick release function, which makes it easy to take them with you to the summer cottage or a visit to friends.

A washing and drying bidet has been installed into the Smart Home toilet seat as an accessory. With a remote control, the device washes intimate areas when necessary, making the work of informal carers easier. The bathroom also contains a range of small assistive devices for taking care of personal hygiene.

The audiovisual modelling and recording system can be used in teaching situations, where the student receives feedback in video format on issues such as working positions when providing assistance.

#### FROM THE MONITORING ROOM, IT IS POSSIBLE TO CONTROL THE AUDIOVISUAL MODELLING AND RECORDING SYSTEM

From the Smart Home's monitoring room, it is possible to control the audiovisual modelling and recording system, which can be used in distance learning, assessment of the students' skills demonstrations, and in different therapy situations. The Smart Home has a camera system that covers all rooms with

this kind of use in mind. In addition, the system includes one movable camera that can be used in various areas. In different kinds of guidance and teaching situations, the person or group working in the area can be given instructions via loudspeakers from the monitoring room, if necessary.



Figure 9. The Smart Home's audiovisual modelling and recording system can be controlled from the monitoring room (Photo: Ronan Browne)

## COLOURS AND CONTRASTS AS PART OF SUPPORTING FUNCTIONAL CAPACITY

The design of the Smart Home aimed to take people with visual impairments or perception problems into consideration. With the help of colours and contrasts, it is easy to see where the support handles in the bathroom are located and where the line between the wall and the floor is. The toilet seat lid has been coloured yellow with tape. In the living room sofa set, the rocking chair can be distinguished from the other furniture by its colour.



Figure 10. The colour of the rocking chair is different from the other seating (Photo: Ronan Browne)

## ENVIRONMENTAL CONTROL DEVICES AND COGNITIVE TOOLS IN THE SMART HOME

In the Smart Home, nearly everything can be controlled with environmental control devices. The Smart Home has a “talking” environmental control device transmitter, which works with picture buttons and has a touchscreen; if necessary, it can be controlled with one separate button. The environmental control devices operate using an IR signal, and they make possible the control

of home electronics, blinds, lights, kitchen, elevator, doors, windows, and wall sockets, among other things. A robotic vacuum cleaner has also been connected to the environmental control system. As an alternative to the traditional environmental control devices, it is also possible to test iPad control for home electronics and lighting in the living room.



Figure 11. Many of the Smart Home functions can also be controlled with environmental control devices (Photo: Ronan Browne)

In connection with the environmental control devices, cognitive and communication tools were also purchased for the Smart Home. On the memory panel next to the front door, you can see if a device (such as the coffee maker) has been left on or if a window has been left open. The connection works with a radio signal between the memory panel and a sensor connected to the device. The same reminder information follows you outside the home in a key fob.

Among other things, the Smart Home has a communicator that repeats recorded speech or sound to facilitate communication. The user interface consists of several interchangeable cards, where buttons that repeat the desired message or sound can be defined in different places and under different icons or images. With separate computer software, additional cards can be created. It is also possible to practice communication with the family using a computer or a mobile phone with an easy-to-use user interface.

## THE SMART HOME HAS SEVERAL SOLUTIONS THAT SUPPORT SAFETY

The Smart Home features several safety-related solutions. The most extensive one is the sensor floor, which informs the care personnel or a family member, if something happens to the inhabitant. The sensor floor observes exiting an area, entering an area, getting out of bed, and falling down, and it can also be connected with a nurse call system. The floor operates using capacitive sensors placed under the flooring. The only part of the equipment that is visible to the inhabitant are the skirting boards, which are slightly higher than usual. As a parallel solution to the sensor floor, the Smart Home has a movable bed sensor operating with motion detectors, which can be used to observe getting out of bed, exiting an area, entering an area, and falling down.

With a separate mobile application, a person can call for help easily and be in voice communication with helpers, even when moving outside the home. The users can be private persons as well as workers in the health care sector. The application sends location information automatically to the assistant as a text message, which alerts help to the right location. As an alternative to the mobile application, the Smart Home also has a safety bracelet, which transmits the location information of the person in need of assistance. The safety bracelet can also establish voice communication with a person providing aid. With the safety bracelet, the user can move in a predetermined area. The device will send an alarm if the user leaves the area. The system includes an RF base station, which can be used to charge the bracelet. The base station also shows when the bracelet is within range. Alternatively, another safety bracelet solution can be used to monitor the inhabitant's activity and well-being.



Figure 12. Safety bracelet (Photo: Ronan Browne)

# LEARNING INNOVATION IN AN INTELLIGENT AND CREATIVE LEARNING ENVIRONMENT

Tiina Lautamo

User-centred teaching in a smart environment at a university of applied sciences requires the development of pedagogy. In strategy speeches, creativity, innovation, and continuous renewal are seen as critical success factors and enablers of economic growth throughout the European Union. Placing creativity and innovations at the core of strategies is not only a Finnish phenomenon. Including students in research and development is necessary for the future development of our society. We need new type of experts, who are able to develop and innovatively create new services and products, with a good competitive ability in the user-centred market of the future. Competitiveness as a concept is foreign to the field of social services and health care, but as social structures change we can no longer afford to produce services in the same way as we have done until now. There are more needs and less money. In order to solve this equation, a new kind of innovative thinking is required to produce cost-effective solutions of high quality that are suitable for real life.

## INNOVATION PEDAGOGY

Innovation pedagogy as a concept has been highlighted as a method of developing the competence of students. Innovation pedagogy is a learning approach, which redefines how information is absorbed, produced, and used in order to create innovations. Kettunen (2008) defines innovation pedagogy as an operating model based on a socio-cultural understanding of learning. Innovation and creativity are emphasised in this kind of teaching, which creates something new. Such an operating model supports the activities of universities of applied sciences as part of regional knowledge networks.

As working life becomes increasingly complex, the development of community competence is needed more than individual competence. Skills and activities leading to competence that can be utilised more easily in working life should be developed in teaching and learning. Didactic solutions are needed to improve competence and to create new innovations. A new kind of pedagogic approach challenges the traditional understanding of knowledge. In innovation pedagogy, learning co-operative methods is combined with creating new information and applying it, and with research activities.



One of the challenges is to create intelligent solutions for the increasingly diverse and individual customer needs in the field of social services and health care. Intelligent solutions are not limited to producing technology, but instead the technology is harnessed to serve the construction of intelligent service models. This does not mean bringing in robots to do the work of people, but other new innovations that combine humanity and technology in an embedded and user-oriented way. In the future, more and more intelligent solutions are needed to produce human services. A change in the ways of producing services and the operating environments of services is the key to improved productivity and effectiveness.

## CO-OPERATIVE PROBLEM SOLVING

On a practical level, innovation pedagogy is communal, investigative, and developing learning and teaching. Learning comes from a functioning team, an innovative learning environment, and the right kinds of authentic learning tasks. New solutions can rarely be built on the insights of a single person. Working in a team builds and creates information. At their best, the solutions to authentic development challenges in society and working life generated from the new information produced also generate good ideas and new innovations.

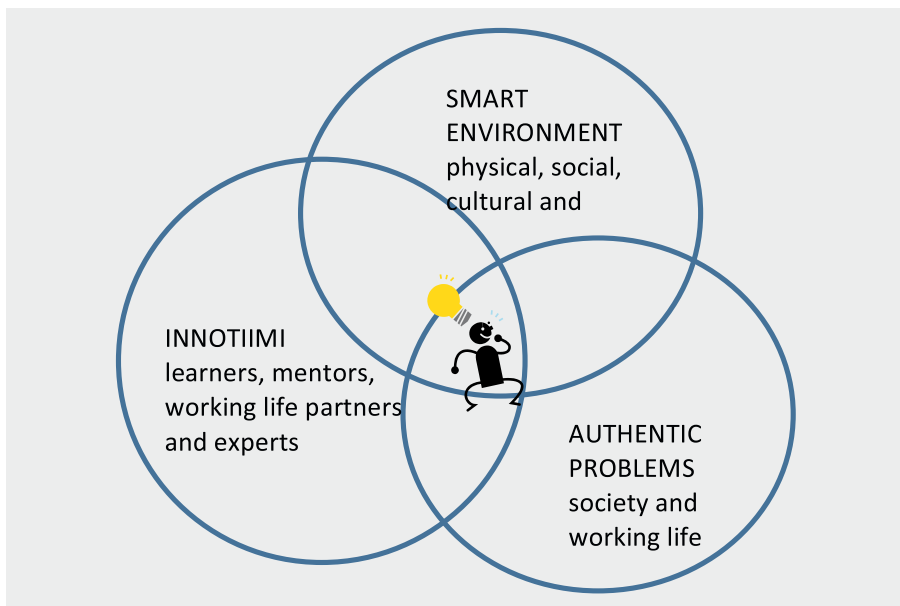


Figure 1. Innovation pedagogy context.

In the last few decades, the talk on creativity and innovation from the point of view of the economy has become part of political and strategic rhetoric. The talk on creativity has included surprisingly little discussion about creativity as a competence. What are those characteristics or abilities of a student or teacher that creativity requires, and what kind of operating environments create new things?

Professor of Educational Psychology Kirsti Lonka (2012) criticises the current teaching practices, stating that even now the result is all too often “bulimic learning,” where students cram in information from books or the teacher feeds them an excess of information. Thereafter, the students vomit the information into a test or essay and promptly forget it. In the future, the society does not need the passive citizens so generated; it needs actively processed and produced information and competence that has been understood in depth and can be applied to solving authentic problems. When applying innovation pedagogy, new and cumulative remembered information and skills are constantly created in the learning environments. Practice-oriented innovation competence that generates entrepreneurship as well as innovation development skills are important competences in the future working life.

New learning methods and practices must be introduced. In planning curricula and teaching content, enough room must be reserved for creativity and concrete learning situations, where it is possible to develop skills needed in the future: for example, the skill to ask and question, reflect, and solve problems. Curricula must therefore be open, flexible, and linked to real life situations. They must be based on existing research information, but in addition, the objectives must include producing new information and productising it. The learning practices must also be flexible, and they must meet the learners’ personal learning challenges and expectations. (Bosconi et al. 2012).

Giving up teacher-centred activities requires a leap into uncertainty, but not into a lack of control. Researchers and experts of learning have developed and continue to develop innovative learning methods. Increasing the active participation of students is common to all of them. The learner’s interest, feelings, and motivation are central factors in sparking learning and giving it depth. In studying, attention must be paid on social factors and the learner’s emotions, which have a strong effect on commitment and motivation. The learners bring their own experiences into the learning situation, and they create their own interpretations on that basis. Learners always decide what they want to learn. In addition to the communal activity in a team, learners are also required to commit to independent work.

Tautila (2012) emphasises the importance of pragmatism as a teacher and in defining the role of a learner. The teaching event is an interactive mentoring event that is bound to the practice. A teacher who is a mentor must have strong pedagogic competence and a sufficiently good knowledge of the subject studied. The teacher's role in the learning situation is focused on facilitating learning and on innovative leadership. The teacher acts as a role model for creativity and innovation, operating in expert communities and development networks and applying the competence learned there to guiding and mentoring students. The activities of the teacher and the student develop in stages, through doing and application competence towards development competence.

New types of solution are born when people start solving authentic problems arising from the challenges in society. Creativity and innovation are created in activities when people move away from the known in problem-solving processes. Creativity and innovation are not the characteristics of an individual, but a series of skills that can be learned. Creative work is a very disciplined activity, which requires commitment to one's own and the team's common goal. Learning requires a new approach based on openness, competence and co-operative processes.

According to Richard Florida (2005), a researcher of innovation politics, creative people do not see their place of work as insignificant. The signs of a creative organisation are freedom, trust, risk-taking, and the aim to create new operating models. A tolerant environment that is open to new ideas enables good, innovative and creative work. The Smart Home as a learning environment can serve as this type of a learning environment, which allows creativity and new operating models, and which attracts students to participating in the construction of new intelligent service models and products. In an intelligent learning environment, the technology is a tool, not an end to itself. A student must identify and learn to use the existing smart solutions in order to gain experiential knowledge about technical solutions. The present must be identified, and it must be possible to define phenomena theoretically so that they can serve as a basis for developing something new. This is why theoretical competence and thinking are also needed in order to conceptualise phenomena. As information and the number of customer experiences increase, a learner will also be able to analyse the challenges that arise from the point of view of technology and individual activity. The birth of innovations is preceded by a long chain, the start of which includes in-depth information, extensive competence, and an ability to combine these in a revolutionary fashion. Humans are in a key position in innovation, but the

system cannot be forgotten either. Culture, norms, values, and structures either promote or inhibit the development of creativity into innovative products and services, which makes innovation a social issue.

Innovation does not necessarily require walls, but walls need innovative team players.

# SMART HOME AS A CONTEXT FOR THE DEVELOPMENT OF COMPETENCE

Mari Kantanen

Learning through activity has been found to be an efficient way to promote the competence of students. In a university of applied sciences, students study for a profession, combining the application of information with practical customer situations. Challenging and diverse situations in working life require employees to have flexibility, inner entrepreneurship, and an ability to operate in both national and international co-operation networks. The goal of JAMK University of Applied Sciences is to promote the competence of students in entrepreneurial and international activities. Research, development, and innovation projects with the aim of regional development are an excellent opportunity for students to develop their own competence in these areas.

## FROM CURRICULUM TO EXPERTS IN A RANGE OF CONTEXTS

The teaching at JAMK University of Applied Sciences is based on a competence-based curriculum. The curricula define the learning objectives that the students will attain during their studies. The learning objectives are determined in accordance with the national and international instructions for the field.

In universities of applied sciences, learning takes place in different learning environments (figure 1). Part of the learning takes place outside the school environment, through experiences in everyday life. Hobbies, work tasks, and different tasks related to social activity promote the attainment of learning objectives. Alongside informal learning, JAMK University of Applied Sciences offers several different formal learning environments in order to promote students' competence. A traditional method of promoting competence is classroom teaching in a classroom that takes advantage of different kinds of pedagogic solutions, such as lectures, group work, or independent learning. A virtual learning environment refers to the different learning opportunities offered by information technology and social media. A key part of the learning of the students at the School of Health and Social Studies takes place as practical learning in working life. In addition, competence development occurs in the project, research and development activities related to regional development as well as the laboratory environments of JAMK University of Applied Sciences.

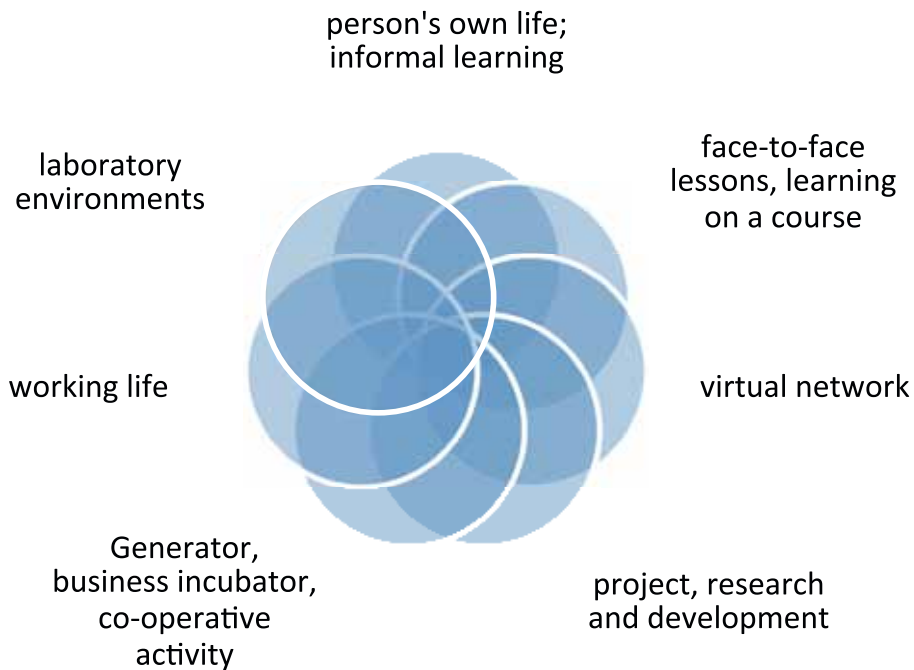


Figure 1. JAMK University of Applied Sciences learning environments.

JAMK University of Applied Sciences' four different simulation environments offer an excellent opportunity to observe different kinds of care and service chains in the social and health care sector. In the environments, it is possible to simulate a client's passage through the different stages of the care and service chain, all the way from home to hospital, rehabilitation system, and back home. Through different client cases that take place in the lab environment, the students can develop their own competence and co-operation in a multidisciplinary work group.

The Smart Home simulates a real home. Its solutions take the accessibility and safety of living into account. In addition, the Smart Home features the latest technological solutions and assistive devices that support daily activities, household work, communication, and participation. With these solutions, it is possible to promote people's independent management of significant functions in their own lives, but also to replace or supplement any skills that may be missing. The Smart Home makes it possible to practice skills central to one's own field in a home-like environment, and it offers good possibilities for promoting the competence of supporting and enabling living at home.

Technological solutions and the acquisition of assistive devices are based on fictional customer cases. Assistive devices and solutions have been designed from four different points of view which make activities harder: 1) a person with cognitive challenges 2) a person using a wheelchair 3) a person with a limited functional capacity in the hands, as well as 4) a person with limited eyesight. Activity analyses were conducted based on the aforementioned case studies with empathy and by thinking about what activities can be done in the Smart Home facilities, on the one hand, and what people generally do at home, on the other hand. Based on these observations, an investigation was started on how challenges in functional capacity prevent people from managing at home or make it more difficult, and how different technological solutions can be utilised to enable activity either by supporting existing skills or compensating for the lack of skills.

A Smart Home acts as an environment for implementing courses and training, as well as a form of service. Students play an important role in designing and implementing the functions of the Smart Home. During its first year of operation, the Smart Home had 1–3 students from different fields doing their practical training for professional growth full time. Each student defines the personal learning objectives for his or her practical training, and they are checked together with the project personnel and the supervising teacher so that they meet the learning objectives of the field. Negotiation, anticipating concrete actions, and planning together make it possible for the student to have learning experiences that meet his or her current learning objectives.

During their practical training, students learn about the solutions in the Smart Home from the point of view of enabling independent and safe activity at home. Together with the permanent staff, the trainees participate in different kinds of enterprise co-operation and presentation events organised at the Smart Home, as well as in planning and implementing teaching at the Smart Home in co-operation with the teacher in charge. Co-operation with companies provides students with good practical experiences in working life co-operation, as well as an opportunity to deepen their competence in the field of independent and accessible living. The promotion of one's own competence in the Smart Home requires the student to be active and take responsibility for his or her own learning. The work promotes the students' multiprofessional competence and skills in working within a network both nationally and internationally. Perseverance, tolerance of uncertainty, adaptability in quickly changing situations, and problem-solving skills develop in parallel with the competence related to solutions that enable independent living.

## TOWARDS SIMULATION LEARNING

Simulation learning is a method whereby skills required at work are practised in a real-like environment. In simulation teaching, a student or a group of students utilises a client case, which may be a written or dramatically enacted situation. In simulation teaching, the students practice performing the action; the performance is either monitored in real time or it is recorded audiovisually. The teacher and possibly also a peer review group consisting of other students views the recording or the real-time performance. Based on assessment criteria drawn up together, the student or student group that performed the simulation as well as the teacher and the peer reviewers give feedback on the performance. After receiving feedback, the student or student group has an opportunity to perform the assignment again in order to correct or complement the performance based on the feedback received. (Jäntti 2007; Velde, Lane & Clay 2009; Tuhkanen 2010.) A high quality recording feature that can be used as part of simulation teaching has been built into the Smart Home.



# A SMART HOME AS AN INTERNATIONAL LEARNING ENVIRONMENT

Kari Vehmaskoski

A smart home refers to an apartment or a building, which features technology enabling the monitoring of the inhabitants and the area, and encourages independent functional capacity and independent activity as well as good health (Chan M. et al 2009). Smart homes have been developed for persons with limited functional capacity, such as disabled and elderly persons, but similar solutions are also utilised in normal homes, for example in environmental control based on infrared technology.

Many universities and institutions of higher education have a Smart Home or apartment, but their level or diversity of technology do not equal the Smart Home of the JAMK University of Applied Sciences. In addition to the physical space of the Smart Home, it must be noted that some of its technologies are movable and they can be taken along with you to international tasks, for example, and, on the other hand, the use of cameras enables distance learning abroad, at least to some extent. Based on my own experience, this is the only real smart home or apartment in Europe located on the premises of an institution of higher education.

JAMK's unique Smart Home environment appeals to many international partners, and new projects and project concepts have been created around it. These can be called Smart Home spin-offs.

The Smart Home environment of JAMK University of Applied Sciences has been utilised in multiprofessional ways in international projects of the well-being sector and technology units. With funding from the German DAAD, JAMK Mechanical Engineering arranged the intensive course "User friendly design and innovations for senior citizens" in 2011 and 2012. The idea of the course in question is to do project work in multinational teams, and the Smart Home provided a good learning environment for the students' development work. The idea behind the course was to provide future equipment and environmental designers in the field of technology in particular with experiences in international project work (Vehmaskoski et al. 2007). There were a total of 70 participants; they were mainly students of engineering and architecture, but students of social services and health care also participated in this multidisciplinary training event. There were also approximately 15 professors and other staff participating from different institutions of higher education. The institutions that participated were the West-Saxon University of Applied

Sciences, Polytechnic University of Catalonia, University of Trento, Technical University of Cluj, and Esslingen University of Applied Sciences. The students who participated published some articles on their experiences. (User Friendly Design and Innovations for Senior Citizens, Progettare in un contesto Europeo ambienti fruibili da anziani e disabili L'esperienza degli studenti dell'Università di Trento nel programma intensivo IP Erasmus in Finlandia 2012.)

Due to the aforementioned events, some of the institutions of higher education that participated created a new SMARTHOME network. The network applied for and received new international funding for implementing a Smart Home-centred course in 2013. New institutions participating in the project include the Fontys University of Applied Sciences from the Netherlands and Thomas More Kempen from Belgium. Their objective is to utilise JAMK's Smart Home experiences in their own common residential block project. This co-operation will continue at least until 2015. (International Intensive Programme Smarthome 2013.)

Behind the training and technical solutions in the SMARTHOME development, there are the international courses organised in 2001–2012 by JAMK in Europe, for example in the Netherlands, Hungary, Sweden, the Czech Republic and Spain – in addition to Finland. In this way, JAMK has been able to develop expertise in the long term as part of an international network in assistive technology and gerontechnology. The need has arisen, on the one hand, from the needs of the increasing numbers of ageing population in Europe and, on the other hand, from multiprofessional co-operation (technology and the well-being sector), as well as the spread of accessibility thinking in the society.

The international projects have promoted some technical innovations (Ylinen et al. 2006) and enabled JAMK's expert role in assistive device technology, for example in the European Leonardo and ERASMUS projects (Vehmaskoski 2008a, 2008b).

One development partner of the Smart Home project was Validia Services of the Finnish Association of People with Physical Disabilities (FPD). The Smart Home environment assisted in a training project focused on Validia; funding for the planning in 2013 came from the Finnish-Swedish Cultural Foundation. The Hjälpmedelinstitut, the City of Stockholm, the housing service provider Micasa, and Abilia, an international company in the field from Stockholm, have already joined the network. The project is a small, local project by JAMK and the Validia unit in Jyväskylä, but on the other hand, it is also an international development project. The Swedish partners in the network are interested in the application of technical solutions in the case of Jyväskylä. Of the companies,

the Swedish Abilia has also delivered equipment systems to the Smart Home ([www.abilia.se](http://www.abilia.se) 2014).

During the summers of 2012–2013, JAMK organised the international summer course “Assistive technology- modern technical applications for health care” in the Netherlands together with the Utrecht University and the Utrecht University of Applied Sciences. The participants of the course were mainly multidisciplinary students of social services and health care from Finland, Spain, Germany, and the Netherlands. Most of the participants were students of physical and occupational therapy. (International Intensive Programme Smarthome 2013.) On this course, JAMK utilised the Smart Home technologies and, as a new trial, the real-time camera system was used to demonstrate the Smart Home’s operating environment to the participants. (Utrecht Summer School 2013.)

The important thing about the aforementioned Summer School has been the co-operation with international companies and research institutes. JAMK and the other universities and institutions of higher education in the network have created working connections with international companies in the field, such as Otto Bock, Össur, SilverFit, etc. This kind of co-operation is necessary, because the companies have the latest know-how in the field. The companies benefit by recruiting students into their projects and later to their work tasks. (<http://www.ottobock.com/> and <http://www.ossur.com> and <http://www.silverfit.nl> 2014)

With these experiences, JAMK is able to use the Smart Home to provide expertise for the needs of the developing working life in the well-being sector, where robotics or games used in rehabilitation as part of the work environment are acute and critical issues. Wireless technology and intelligent environments are also part of the future work environment, and with training we can promote knowledge and decrease the fears and prejudices related to technology. The goal is to promote the well-being of citizens as a whole, and to take into account the human factors in the different applications of technology.

# EVALUATING EVERYDAY ACTIVITIES IN THE SMART HOME AS PART OF HOUSING TRAINING

Leena Yksjärvi, Paula Tapani & Miia Peltonen

The objective of the co-operation between Validia Services Jyväskylä and JAMK University of Applied Sciences is to increase concrete co-operation between the university and working life by taking advantage of the Smart Home learning environment and working life competence. This is made possible by combining the students' latest research information with the special working life expertise. The central goal of Validia Services is to develop and expand the assessment system of disabled customers in housing training and to receive the latest environmental control technology to be tested by the clients, with the help of the Smart Home. The goal is to create a local high quality assessment, testing and experimentation environment for disabled persons, where the client can, together with therapists, go through different options for controlling everyday life. Trying out assistive devices in practice in order to find the ones that are the most suitable for the client's home and use and having time to learn to use them prevents purchasing assistive devices that are unnecessary or do not work.

After the Smart Home was completed, the co-operation with the Smart Home and the housing training by Validia Services has been implemented by piloting kitchen function assessments. The pilot was implemented in co-operation with selected housing training customers and occupational therapy students. The purpose of the kitchen function assessment was to find out more detailed information on the customers' motor and process skills with the MOHOST (Model of Human Occupation Screening Tool) and AMPS (Assessment of Motor and Process Skills) assessment methods. At a later stage, the plan is to test other aspects of functional capacity, and the recording feature, and to increase multidisciplinary co-operation. The multiprofessional approach brings added value to the Validia assessments done at the Smart Home.

The customer assessments done at the Smart Home have provided additional support and confirmation to the assessments and observations made in housing training. The need for a more detailed assessment of the client's motor skills and process skills in particular often arises from other assessments during the housing training period, and at this stage, it is possible to take more detailed standardised assessment methods into use. Clients have given positive feedback on the modern operating environment, and they

have felt that the assessment creates variety. The Smart Home kitchen is a suitable environment for the assessment of housing training clients, because technological solutions have been used to incorporate adaptability into the kitchen. Adjustable furniture can be used to either enable or prevent activity, simulating the current status at the client's home. Clients have been very motivated to learn about an unknown environment and they have appreciated the "feeling of working together."

# SUMMARY

Essi Heimovaara-Kotonen

The wishes of people who need special support about housing do not differ from the wishes of other citizens. The basic prerequisites for independent living and functional everyday life are accessibility and safety. Independence and living in one's own home are things that people value, even when they are dependent on different type of services due to their functional capacity. Ensuring good housing requires that the living environment is adapted to be suitable for people of all ages and to enable living. The home must be flexible and adapt to the client's functional capacity and preferences, not vice versa.

The ease of everyday life can be promoted with the help of many kinds of assistive devices, and in addition to independent living, new technology can be used to support nursing and make rehabilitation easier. Well-being and ICT technology offer many a range of new possibilities for supporting living at home and enabling social interaction and participation.

The goal of the Smart Home is to present solutions that enable accessible and safe living and promote meaningful activity at home. The goal was to find the client a user-oriented, comprehensive solution that preserves the inhabitant's own control over his or her home environment. Meeting the housing needs of special groups requires a genuinely client-oriented approach and co-operation between different parties, experts, professional groups, and the inhabitant.

The Smart Home environment serves as a centre of expertise for the well-being sector, sharing information about intelligent and safe living, increasing general knowledge of solutions that make living and assistance easier, and clearing away prejudice related to special groups. The facility offers both end users and professionals an opportunity to learn about different solutions and their practical application. The Smart Home features solutions that can be tested and applied individually; these solutions make daily life, living at home, and providing assistance in different type of situations easier; the physical and occupational therapists in the area can utilise the possibility of testing the solutions, for example as part of the process of making changes in an apartment or acquiring assistive devices.

As a learning environment, the Smart Home equipment represents innovative health technology, which strengthens the competence of future professionals in social services and health care in utilising technology to support living, nursing, and interaction. It is more certain that theoretical

knowledge competence will transform into practical working life skills, when the students have an opportunity to study different technological solutions in authentic situations and to try them out in practice as well as in simulated situations. Environments equipped with technology are part of the work communities of the future. With the right education, we can promote the knowledge of future professionals and decrease the prejudices and fears related to technology.

The audiovisual modelling and recording system of the Smart Home supports learning and guidance. The audiovisual system can be utilised in teaching situations, where the student receives feedback in video format about issues such as ergonomics when moving the patient or providing assistance. In guidance and teaching situations, instructions can also be given to the student via loudspeakers. The system can be utilised in various ways in distance learning, assessing the skills demonstrations of students, and in different kinds of therapy and interaction situations.

In addition to JAMK University of Applied Sciences, the other educational institutions and companies in the area have the opportunity to use the Smart Home environment as part of their teaching, continuing education, or other activities.

The purpose of the Smart Home is to develop the clients' well-being from a needs-oriented basis and to produce entrepreneurship based on new competence. The partner companies can take advantage of the home environment in testing their own new service products; examples include different kinds of club activities, assessment of functional capacity, and product presentation and testing.

Companies also have the opportunity to put their products on display at the Smart Home and give them to customers for testing via the exhibition area service. Products selected for the Smart Home must promote independent living at home and be available to consumers. It is also possible to agree separately on testing prototype products in the environment when they are not yet on the market, in which case the Smart Home serves as a Living Lab environment for the companies. This enables the testing and research of housing functions and well-being technology products with real end users. The Smart Home and the events arranged there have also brought parties together, enabling a new kind of product development co-operation between companies.

The Smart Home also serves as a place where constructors and developers can meet, for example when acquiring new safety technology. The furniture solutions available for testing have aroused interest in developers of service houses, in particular.

The great solutions at the Smart Home have been used in different type of brochures and guides on housing for special groups. In addition, the Smart Home has commissioned several guides where supporting activity by adapting the environment is emphasised. Examples include the thesis “Värillä on väliä muistisairaana elämässä” (Colour matters to a person with a memory illness) and the guide to a good meeting with a client with difficulties in communicating, “Kommunikoi ja kohtaa” (Meet and communicate).

The Smart Home provides a diverse range of opportunities for students, entrepreneurs, and partners to create new and develop existing competence both nationally and internationally.



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The objective of building the Smart Home learning and development environment was to find a user-oriented, comprehensive solution for the client, which maintains the client's own control over his or her home environment. The facilities were also built to serve the development of new service concepts that were even more cost-effective and client-oriented than before in co-operation with working life parties. As a learning environment, the Smart Home serves as a creative environment open to new ideas, which also challenges students to participate in the development of new service models, products, and skills in a multiprofessional fashion.

The Smart Home serves as a centre of expertise for the well-being sector, sharing information about intelligent and innovative living, increasing general knowledge of solutions that make living easier, and clearing away prejudice related to special groups.

This publication describes the solutions at the Smart Home from the point of view of learning and development environments, considers the Smart Home in a pedagogic context, and presents experiences from different pilots implemented in co-operation with working life parties and international partners.

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