

Prototyping Future Visions of Vulnerable Youth Through Design for Longevity and Gender Equity

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Abstract

This paper presents recent findings from research conducted in Budapest, Hungary, focusing on future well-being and visions of vulnerable youth from a gendered perspective. This collaborative inquiry between the Social Design Hub of Moholy-Nagy University of Art and Design Budapest (MOME), Massachusetts Institute of Technology (MIT) AgeLab, and MIT Ideation Lab explores the concept of Design for Longevity (D4L) in a gender-sensitive context with vulnerable youth groups. Through the application of the 4Es framework: Ensure, Evolve, Empower, and Enjoy, the study aims to empower vulnerable youth by integrating design processes and making into alternative school curriculum pedagogy. Participants from Belvárosi Tanoda Foundation Secondary School engage in workshops to explore gender-sensitive approaches to longevity and well-being. The study emphasises a vulnerability-informed approach and observes the impact of gender identity on group dynamics and ideation processes, outlining the importance of a gender-inclusive approach in building future visions among youth. The preliminary study's impact extends beyond the benefit to vulnerable youth (workshop participants), encompassing valuable academic contributions. These include broadening the application of ethnographic approaches, employing participatory methodologies with disadvantaged communities, and highlighting the significance of gender equity and D4L.

Keywords

Design for longevity
Social design
Gender equity
Participatory design

Introduction

This paper presents recent findings of a research conducted in Budapest, Hungary, focusing on future well-being and visions of vulnerable youth through a gendered perspective. In what follows, recent explorations are presented on how teaching design and prototyping skills can empower vulnerable communities, enabling them to express their future selves creatively. The scope of the research was defined by the target group of vulnerable youth, whose future visions in well-being were placed at the centre of inquiry through their involvement in inclusive and participatory design processes. The inquiry was initiated as a collaboration between the Social Design Hub (SDHub) of the Moholy-Nagy University of Art and Design Budapest (MOME) and the Massachusetts Institute of Technology (MIT) AgeLab under the working title *Design for Longevity through the Lens of Gender Equity* (D4L for GE). The D4L for GE research aimed at integrating previous research findings from both institutions, such as the topic of gender equity at MOME SDHub and design for longevity at MIT AgeLab. Fig. 1

The MOME SDHub conducts practice-based research at the intersection of social and environmental sustainability, seeking solutions to reduce inequality and foster resilience. A central aim of its ongoing research projects is to develop and support practice-based design inquiry in order to seek opportunities for a more sustainable lifestyle and economy. A recent research project, FRUSKA, investigated how disadvantaged girl groups can be supported through design tools (Anonymous et al., 2023). The FRUSKA method and workshop series enables girls aged 10-18 to engage in a creative learning process, while providing the framework for a participatory research and self-assessment. Through different workshops, participants master technological skills and experience the freedom of choice through the customization of the items they create. Based on participatory design and mutual learning, the program is designed to enhance the girls' self-esteem, sense of autonomy and empowerment to give them better chances later in life and in work. The FRUSKA Handbook offers a methodological framework, a recommendation for a workshop series, and an array of impact measurement tools such as pre- and post-workshop surveys and self-assessment tools. The FRUSKA Handbook served as a baseline for building up the framework of the D4L for GE research both in terms of participatory inquiry, assessment and a gender-sensitive approach.

As people live longer and aspire to have better quality of life, disruptive demographic shifts (Coughlin, 2014), advances in medical and healthcare systems, and the emergence of innovative technologies (Etkin, 2021) have propelled most developed countries into the era of longevity economics (Coughlin, 2017). Particularly within service- and experience-dominated industries (Lee, Yang, et al., 2023; Lee, Patskanick, et al., 2023), the concept of D4L has gained paramount importance, expanding beyond conventional financial planning to encompass various domains including education, family, community, risk, investment, mobility, and future considerations. The concept of D4L and 4E frameworks, inspired and co-developed in collaboration with the MIT AgeLab, aims to explore longevity planning in response to disruptive demographic changes, the longevity

economy, and shifting perceptions of life stages. D4L offers a novel perspective for comprehending, exploring, and celebrating the individual's diverse stages of life, inclusive environments, dynamic workforces, and various cultures across generations. The traditional three-stage model of life — birth, education, and retirement — is being redefined (Golden, 2022). Through the lens of D4L, researchers and designers can address complex socio-technological challenges holistically, centred around the experiences and needs of individuals throughout their lives. In this study, we utilised the D4L framework (Lee, Coughlin et al., 2023) through four participatory workshops and four semi-structured interviews to comprehensively examine, explore, and discuss the research topic of future visions of vulnerable youth through a gendered lens.

GE as a larger aim appears in this domain through its wider relevance in youth's future visions. It is widely established that male and female students' future visions are influenced by social bias especially when choosing a career path, which is particularly visible in STEM or careers perceived as more family-friendly (Weisgram & Diekman, 2017), such as caretaking careers. The gender stereotype of science has been analysed via a variety of quantitative and qualitative methods (Makarova & Herzog, 2015; Cooper & Radonjic, 2016). Applying a gender-sensitive research approach was crucial throughout the research not only by choosing appropriate methods and tools, but by making sure that the participation was inclusive of male, female and non-binary students. Choosing the right language, inquiry method and group selection was suggested by the students, based on the ratio of 10 female, 8 male and 3 non-binary participants. A conscious choice was made not to divide participants by their gender identity, creating mixed groups and emphasising this lens in the survey and interviews instead.

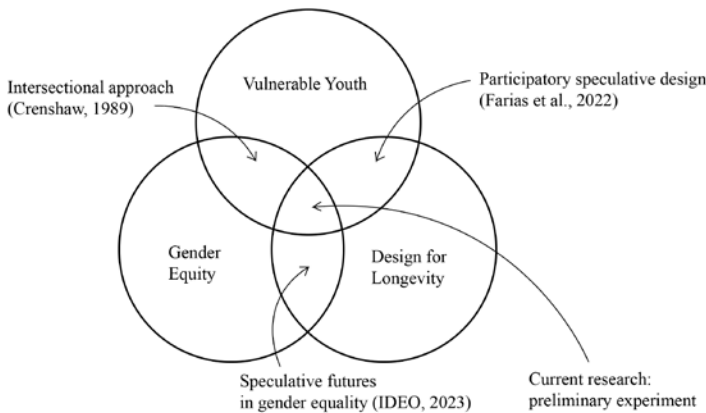


Fig. 1
The relationship between vulnerable youth, Design for Longevity (D4L), and Gender Equity (GE).
Source: Authors.

Research Question

Based on the previous research project FRUSKA, the study focuses on exploring, integrating, and creating the concept of D4L in a gender-sensitive context with vulnerable youth groups. Therefore, the proposed 4E questions were applied as a medium to connect FRUSKA with the concept of D4L. The 4Es framework is a tool to help participants form the target group, brainstorm concepts and ideas for tangible and actionable answers that address issues of longevity. There are four stages to the framework: ensure, evolve, empower, and enjoy. Each stage offers a question to guide participants to think more dimensionally about the challenges and opportunities of longevity.

The overarching research question touched on whether we can use design and making to empower vulnerable youth groups with creative confidence through a gendered lens, and aimed to explore the value and the process of implementing design thinking and making for the alternative school curriculum pedagogy. However, several further research questions were formulated in a participatory way by student participants in a group format, which further led their inquiry into their own future visions. These questions were generated by applying the D4L cards in the form of template questions and are further elaborated in the Methodology section.

Target Group: Vulnerable Youth

The target group of the inquiry was broader: vulnerable youth, defined by a specific school educational context. Participants were all students enrolled in the Belvárosi Tanoda Foundation Secondary School, a foundation-based institution that aims to create the opportunity for a fresh start for high-school dropouts between the ages of 16 and 25, to earn their diploma.

The vulnerability of these students usually stems from their social position, previous educational background, occasional mental health and substance abuse issues, and challenges in the home. The school's pedagogical methodology is designed to serve the unique needs of its students while creating a sustainable, loving and open-minded community.

The personalised learning programme is customised together with the student. The curriculum is organised into thematic courses, with a credit system that supports individual progress. Students work on part of the curriculum using a project approach, which also helps them develop a wide range of key competences. Students are supported in their school life — and, if necessary, in their personal life — by a mentor or support pair of their choice. Student-mentor pairs prepare the student's timetable and exam schedule, regularly assessing the progress and adapting the established learning programme as necessary. Each term ends with an assessment interview, with a strong emphasis on self-evaluation. Organising school work is collaborative. The school is run on a democratic, consensual basis, which helps build a strong sense of community. The mentors' work is supported by weekly case discussion meetings. In the small school community, open communication is encouraged among tutors and students alike.

Looking at the school’s target group, several significant characteristics may be observed. According to the surveys conducted by the school, students aged 16-17 who are new to the school feel less developed in terms of self-esteem and confidence (Szebényi, 2021). 18-19 year olds, who have been in the school for an average of 1.6 years and are planning to take their school-leaving exams this year or next, scored lower than the others on their preparation for studies, course exams, school-leaving exams and entrance exams. Above the age of 20, the average scores clearly increase with age. In particular, 20-22 year olds score significantly higher on preparation for studies, examinations, school-leaving exams, entrance exams and on developing problem-solving skills.

Most students completed the four in-person workshop sessions with the researchers and shared their learning and feedback through post-surveys and post-workshop interviews. Student participation was voluntary but the timeframe was defined within the students’ Social Studies classes.

Design for Longevity Through a Gendered Lens.

Exploring D4L Through the Lens of 4ES Framework and GE

Based on the FRUSKA and D4L research project, the study was dedicated to the exploration and integration of GE. To achieve this, the authors leveraged the proposed 4Es framework, utilising them to link FRUSKA with D4L and GE. The 12 D4L cards were crafted based on the 4Es framework. These cards served as an inspirational tool, aiding participants in brainstorming concepts and ideas that could be transformed into tangible, actionable solutions addressing issues of longevity and gender equality. The 4Es framework, structured around four stages—ensure, evolve, empower, and enjoy—provided a series of questions aimed at guiding participants to think more expansively about the challenges and opportunities related to longevity *Tab. 1.*

4Es	Ensure	Evolve	Empower	Enjoy
Explanation	Foundation	Transformation	Extension	Outcome
Guiding questions	What do you need to ensure ? What is basic to your future wellbeing?	What needs to evolve with you? What transforms with you over time?	What can empower you? How can you extend your impact?	What do you enjoy ? What outcomes do you benefit from?

Tab. 1
The 4Es framework explanation, guiding questions, keywords, and examples.
Source: Authors.

In this experimental research, the authors employed the D4L framework and insights learnt from the FRUSKA project to comprehend GE by reframing, researching, translating, and prototyping solutions specifically aimed at the participants from the Belvárosi Tanoda Foundation Secondary School as the target group. This initiative sought to envision a future through a gendered lens that is more inclusive, ethical, delightful, and respectful, with a focus on designing services, systems, and strategies that cater to the needs and aspirations of vulnerable communities.

Based on previous research in the domain of gender equity in social design with vulnerable youth, a gender-sensitive framework and research focus was drawn up (Csernák et al., 2023).

This framework was based on Intersectional Theory (Crenshaw, 1989) and Critical Feminist Theory (Krumer-Nevo & Komem, 2015) and Critical Participatory Action Research methods (Aziz, 2011). Gender as a concept was integrated into the pre- and post-workshop surveys in order to identify possible differences in future concepts within the target group. Furthermore, the introductory class during Week 0 raised the question of group organisation. Originally, it was suggested to form two groups based on the gender binary, but in the end mixed groups were established, following the suggestions of cis-gendered members with respect to several non-binary classmates who were not present at that time, but planned on joining at a later stage. Therefore, a sensitive, inclusive framework and language was established by the group members themselves, creating a safe environment for an authentic array of gender expressions, especially in the context of the inquiry. In verbal feedback sessions at the end of each workshop, a frequently expressed thought was the feeling of trust (within the group), and a climate that encouraged opening up.

Methodology

The D4L for GE research aimed to integrate pre-existing methodical elements of the aforementioned research results into a broader design thinking process, with a strong emphasis on a gender-sensitive and vulnerability-informed approach. This approach is characterised by voluntary participation (which can be stopped anytime), a mindset reactive to the gender characteristics of the class (participants voted to not divide groups by gender, including instead a non-binary category in the surveys), and regular feedback loops. The workshop design process was transparent and respectful. We recognized the needs of vulnerable communities and collaborated closely with their class teacher to understand the class dynamics, privacy concerns, and the situation regarding grouping and exercise design.

The research was based on a primarily qualitative measurement framework. During the study, a primary desktop research was conducted, which focused on the analysis of existing literature and previously conducted workshops on longevity, prototyping, and gender equity for vulnerable communities.

This was followed by the formulation of the workshop programme structure as a form of inquiry. The inquiry was further informed by data collection through pre- and post-workshop surveys, resulting in a comparative analysis of the participants' self-evaluations, integrating their ongoing recorded feedback and the design concepts they presented. In the case of the pre- and post-workshop survey results and semi-structured interviews conducted with participants and tutors, ATLAS.ti was used for semantic analysis (Stewart, 2023). Main research goals include creating additional elements for expanding the FRUSKA and D4L in different scale applications, developing a gender-sensitive understanding of the target group and their future perspective on wellbeing, and refining the definition and applications of D4L (4Es framework) in the context of disadvantaged communities, further applicable to Tanoda or other alternative schools.

Research questions were formulated by students in a participatory manner in group work settings. In order to help the group reach a consensus in their future vision, the D4L cards and research question templates were applied. The questions were modelled after the following structure: Card A + Card B + Card C = Design Challenge / Design Problems Fig. 2. As an example for the students to build their own questions, were the cards Community, Health and Communication to be picked, the research question would have sounded something like *How might we design a communication product to provide physical/mental health services for/to/with my local communities?*. Based on this, three distinct How Might We (HMW) questions were formulated by the groups: “HMW design a community-centred service to solve future financial challenges?”; “HMW design an educational tool for community use that helps multi-generational financial planning?”; and “HMW design a future for communication to solve problems at home?”.



Fig. 2
Participants used D4L cards as a tool of inspiration to explore and formulate their group challenges.

The workshops were conducted so as to create a space for the vulnerable youth to articulate their future visions in the form of co-created design concepts, based on their own research questions over the course of three weeks, followed by a presentation session in which final concepts were presented by the groups to a wider audience, as shown in the timeline in Fig 3. The case study below presents the matrix of the series of three workshops with three participating groups, focusing on the aspect of the process instead of the design outcome. The applied research framework informed the activities towards a structure that combined frontal and non-frontal learning environments. The four-workshop experience was designed to foster a respectful, open-minded, and creative environment that encourages vulnerable communities to express themselves freely. Each workshop included a 15-minute lecture, 60-minute hands-on activities, and a 10-minute reflection session to conclude.

Overview: Case Study

As discussed earlier, the research flow was characterised by the fieldwork as the most intense period. This phase spanned over 1+4 weeks, with an introductory class on Week 0, followed by a trimester break, 3 weeks of workshops and a final presentation on week 4 Fig. 3.

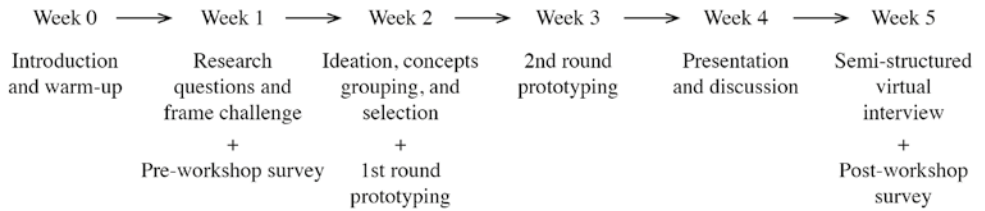


Fig. 3
The 6-week workshop research flow. Source: Authors.

In what follows, a case study of the fieldwork process is described through a matrix of workflow [Tab. II](#) and group work. The workshop series were divided into three different moments and preceded by week 0 as an introductory class consisting of a briefing, icebreakers and a co-creative team building exercise. Week 1-3 followed a largely typical design thinking process, which brought together certain tools from the previous D4L- and GE-focused research, such as the D4L card set, and assessment tools developed during FRUSKA.

Week 1 featured an introduction, a briefing, and time dedicated for a survey, followed by a structured brainstorming session using the D4L cards and the template question (HMW + Card A + Card B + Card C). Groups were asked to select three cards and formulate their research question based on shared interest and future visions, both reflecting on their individual and group preferences and on wider societal needs. These questions were later used in Week 2, when groups were asked to further reflect upon how to respond to their design challenge. They came up with at least 10 ideas per group, which were later narrowed down to 2-3 each. After the groups elaborated on their topic, a short explanation of high and low resolution prototypes was provided, allowing them to start prototyping for the sake of storytelling. A variety of materials were provided for this purpose (soft fabric, wood samples, paper, markers, glue, LEGO, building blocks, etc.).

Prototyping also helped them narrow their ideas down to a final concept each, based on their ability to express or visualise their narratives. While this medium-based restriction might have prevented some good ideas from blossoming, it also helped the group to settle on a shared vision that everybody could contribute to in a clear and understandable way. In Week 3, groups were asked to further refine their prototypes. At this stage, each group was offered two distinct design directions in order to clearly define outcome expectations.

For the presentation on Week 4, all groups were asked to frame the process through their research question, presenting the design concept and concluding with a summary based on the five questions (*What-Why-Who-Where-How?*). For the final presentation, each group completed an assignment during the last week that further developed their design concept, each team choosing a format that was the best fit to describe their process and results.

The matrix below [Tab. II](#) provides a structured description of the workshop process.

GROUPS	Week 0. Workshop Preparation	Week 1. Workshop Research question	Week 2. Workshop Low-res prototype	Week 3. Workshop Hi-res prototype	Week 4. Presentation
GROUP 1	Introduction, briefing, research outline, ice-breaker exercises Structured ideation in 2 groups on valued personal qualities through symbolic language (imaginary hybrid animals as embodiments of adjectives)	HMW design an educational tool for community use that helps multi-generational financial planning?	New educational model based on solidarity economy	Manifesto of a new model school, Poster with main slogan	Vision board, manifesto of a new model school
GROUP 2	Structured ideation in 2 groups on valued personal qualities through symbolic language (imaginary hybrid animals as embodiments of adjectives)	HMW design a future for communication to solve problems at home?	Tutorials for better communication at home	Floor plan and small-scale model for a family retreat supporting mental health and communication	Concept presentation and brochure for the facility and its functions
GROUP 3		HMW design a community-centred service to solve future financial challenges?	An app for multi-generational financial planning and education	Wireframe and content for an online platform of the app	Visual identity for the app, short testimonial video

Research Medium

Four research mediums were prepared, consisting of physical assets and methodological components: 1. the medium for understanding (pre- and post-workshop surveys); 2. medium for inspiration (D4L cards); 3. medium for creation (prototyping tools), and 4. medium for reflection and discussion (semi-structured interview). Due to the project's scope, this paper will not address the findings from the surveys and interviews.

Medium for understanding: pre- and post-workshop surveys. The survey design comprises four main sections: 1. Self-Expression: delves into participants' perceptions of themselves and their communication patterns within their families, social circles, and communities. 2. Creative Confidence: aims to uncover the participants' unique strengths or "superpowers," such as their areas of expertise and the sources of their confidence in life. 3. Problem-Solving: seeks to explore the participants' understanding of the prototyping and design processes. 4. Demographics: gathers basic demographic information about the participants. The purpose of using both pre- and post-workshop surveys is to gain insights into our participants. These surveys help us understand their comprehension of design and prototyping concepts, their interests, expertise, expectations, and concerns. Additionally, by comparing the pre- and post-workshop survey results, we can identify potential research challenges and comprehend individual learning objectives and needs effectively.

Medium for inspiration: D4L cards. During the initial two weeks of the workshop, the utilisation of D4L cards serves as an inspirational tool aimed at empowering participants to envision their future selves. These cards prompt participants to envision various aspects of their lives, including family, community, education, mobility, finance, investment, risk, and many other future directions. The D4L cards feature 12 broad directions, each accompanied by four actionable verbs—ensure, evolve, empower, and enjoy—providing guidance to help them grasp and embrace the concept of D4L within the context of longevity planning and gender equity.

Tab. II
Matrix of the workshop process, describing each group's design journey (HMW = How Might We).
Source: Authors.

Medium for creation: prototyping assets. During Weeks 3 and 4, we provided participants with a range of accessible and low-cost prototyping materials (Buchenau & Suri, 2000), such as LEGO, wooden blocks, thick paper, magazines, markers, Post-its, scissors, metal wire, and glue Fig. 4. These resources were provided to facilitate hands-on learning and enable participants to fully engage with the spirit of prototyping. By actively creating prototypes, participants learned to think with their hands, gaining practical experience in translating ideas into tangible artefacts. Moreover, these physical materials served as tools for enhancing team communication and enriching collaborative brainstorming.



Medium for reflection and discussion: semi-structured interview. We employed virtual interviews with three groups and one-course lecturer in the fifth week. Each interview was conducted in a conversational format for approximately 15-20 minutes. The four interview videos were recorded in Hungarian and translated into English transcripts for qualitative synthesis by applying ATLAS.ti, a computer-assisted qualitative data analysis software (CAQDAS).

The four key research mediums were utilised to understand our participants, inspire exploration, facilitate creation for prototyping, and encourage reflection for discussion. These media played a crucial role in fostering trust between the researchers and the participants, particularly in the case of vulnerable youth. Furthermore, the medium contributed to the establishment of a participant-friendly and safe research environment, conducive to open dialogue and meaningful engagement.

Fig. 4
The prototyping workshop in weeks 3 and 4, during which participants, divided into three groups, transformed their conceptual ideas into tangible models. Source: Authors.

Reflection and Analysis

Workshop Grouping

As discussed above in section 1.3., gender identity played a crucial role in group dynamics and overall content during ideation and prototyping. Though the participants decided not to create groups based on gender categories, this distinction could be maintained through their reflection in surveys and interviews. This also led to an opportunity to observe a more realistic, life-centred strategy in shared vision-building, where even gendered tendencies were encouraged to merge for a mutually approved concept. In general, the above-mentioned biases were both observed by the authors and

articulated regularly in feedback sessions, relating topics such as Care, Family, or Home to female terrain and topics such as Investment, Risk, or Mobility to male terrain. Topics of Health, Education, or Communication were deemed important by participants of both genders, and non-binary participants were more strongly inclined towards topics favoured by female participants. These observations were further confirmed by participant reflections in the interviews.

Moreover, as articulated by participants when reflecting upon internal group dynamics, different gender expressions and their inclinations toward certain topics were collectively shaped to form consensus in a democratic decision-making process in order to reach a shared future vision integrating all the priorities of group members. When asked to reflect upon this community-based decision-making process, participants admitted to learning a lot about each other through their priorities, goals, and insights during mutual persuasion. As a wider reflection upon the design process, creating concepts based on these shared values can be assumed to have a beneficial effect on gender-inclusive future visions among youth, although the results presented here certainly cannot be considered representative.

The challenges that were encountered during the workshops arose from the novelty of the topic of design and prototyping for vulnerable communities. For many, this may be their first exposure to prototyping skills to explore and discuss the concept of longevity. Additionally, the target group's specificities sometimes resulted in a short attention span, difficulty focusing during classes, and stimuli-seeking behaviour (such as moving around during classes or scrolling on their phones). Negative group dynamics were detectable at the beginning of the process (such as bullying), but they stopped as the process progressed, as students' focus was diverted toward productive activities.

Workshop Engagement

Throughout the process of four in-person workshops and group virtual interviews, we reflected on the nuances of individual engagement levels concerning object prototyping, peer interaction, and virtual interfaces.

Engagement through objects. Utilising tangible prototypes proved instrumental in stimulating concept generation, facilitating team communication, and empowering participants to manifest their perspectives on sensitive topics, future scenarios, or personal narratives with regard to longevity. For instance, one participant articulated her vision of a learning environment by constructing a traditional classroom using wooden blocks, complete with a blackboard, five chairs, and a stage.

Engagement through peers. The workshop's objectives and structure were crafted to foster collaborative group learning. As a result, most design exercises necessitated active participation through teamwork. Despite varying levels of engagement among participants, a spirit of openness and willingness to share ideas fostered a collaborative atmosphere. Various team dynamics emerged as three groups tackled diverse design challenges, demonstrating the versatility of collaborative problem-solving with peers.

Engagement through interface. Comparing in-person presentations and virtual interviews has helped us gain insight into the behavioural side of vulnerable youth. Differences in participants' willingness to engage and share their reflections when interacting with peers versus through a virtual environment, highlighted variations in perceived levels of trust and safety. For instance, while some individuals may feel reserved or nervous speaking in front of their peers, they might become more expressive once the interface transitions to a virtual format.

Conclusion

During this three-month preliminary research phase, we applied qualitative research, which involved the facilitation of five in-person participatory workshops across five consecutive weeks, conducting four semi-structured group interviews with students and a tutor, and administering pre- and post-workshop surveys. Applying the lens of gender equity, the FRUSKA project, the Design for Longevity (D4L) concept, the D4L cards, and the 4E questions — Ensure, Evolve, Empower, and Enjoy — have been instrumental in aiding vulnerable youth from the Belvárosi Tanoda Foundation Secondary School to envisage their future selves. This was achieved by fostering an understanding of the design process, encouraging hands-on problem-solving, promoting collaboration, and facilitating storytelling as a means of projecting their aspirations and overcoming challenges.

As a first-hand reflection, we conclude the field-based section of the research with the validation of several experimental research tools, such as using participatory research tools during research question formulation, testing the D4L cards in a novel setting, or adapting gender-sensitive visionary prototyping in a different target group of vulnerable youth. Based on participant feedback and the authors' observations, these methods turned out to be not only effective but meaningful in the given context, resulting in a heightened sense of empowerment among participants, a stronger hold on crafting future visions, and a more aligned and community-centred vision within group members.

The contribution of the research resides in our inclusive and respectful strategy for engaging vulnerable youth via prototyping, facilitating their empowerment to envision their future selves for longevity through the application of design processes. This innovative and participatory approach benefits the vulnerable youth and brings academic value by extending the implication of ethnographic research, employing a participatory methodology with disadvantaged communities, and emphasising the importance of gender equity, thus laying the groundwork for future studies.

Data analysis at a later stage of the research will conclude whether working with vulnerable youth through design can enhance their creative confidence and whether applying a gendered lens can shine a light on the process of implementing design thinking and making for an alternative school pedagogy and for envisioning more equitable future visions. Further studies could explore how different group settings can affect the participatory research or the co-creation process during prototyping, especially whether gender identity influences decision-making, prioritising or refining the details.

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