A Model-driven Approach to Decision Support for Designing Inclusive Services

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Abstract. A service that is inclusive is usable regardless of the functional abilities of its users. Increasing the inclusiveness of critical services such as higher education contributes to reducing disparities and can be viewed as an institutional value proposition for society as a whole. However, the notion of inclusion is becoming more multifaceted and context-dependent. Addressing it at scale often takes the “watering can” approach, which is resource-intensive and may not be effective. As a basis for better service design decisions, as well as planning and allocation of resources, we introduce an approach to representing, analysing and communicating the structure of institutional service environments. In an ontological model of inclusion in a service, we demonstrate that inclusion problems result from a mismatch between environmental factors and user characteristics. Using public higher education as a case of application, we characterise the mismatch in a phenomenological model of a service – a university course. The viability of the approach has been validated by a group of practitioners with expertise in the design of university programmes and holding the power of organisational decision-making. The approach we propose enables service designers to identify and systematically address inclusion problems in their respective service environments and can be applied to services other than the one under consideration.

Keywords: Conceptual Modelling · Public Institutional Service Design · Inclusive Education · Qualitative Risk Analysis.

1 Introduction

What makes a service inclusive? In the most general view, an inclusive service is designed and delivered to meet the needs, preferences, and functional limitations of a diverse range of users [1, 2]. No service, however, can be fully inclusive of any and all users across the complete spectrum of human diversity with respect to their biological, cultural, societal, cognitive and psychological characteristics. Therefore, we delimit the discussion of service inclusion to the value proposition
of a service in a particular context which then determines its inclusion problematics and constrains the search for inclusion solutions. Public institutional services such as education are a particularly challenging area for analysing inclusion issues. As a subset of public services, they are subsidised by the government and are provided to all citizens by an organisation or an establishment founded with a single purpose. For example, universities as institutional establishments aim at improving the level of education and closing the skill and knowledge gaps.

This paper is concerned with higher education as a public institutional service that is provided by universities as institutional establishments. It can be regarded as a critical service given its significant role in personal development, social mobility, economic growth, and an overall societal progress. We delimit our work to the issue of functional inclusion in critical services which, if realised, can be seen as a value proposition to society as a whole since people depend on being able to use them regardless of their functional ability [3]. The knowledge regarding how public institutional service systems, relationships, and interactions should be designed to serve diverse users is often fragmented. Service development projects often adopt a “watering can” approach to cover as much ground as possible, yet tend to fail to serve all but the “average” user [4]. Developing inclusive services at scale, also known as “universal service design” [5, 6], requires appropriate approaches for systematising the knowledge about problems that arise for non-average users at the service touch-points of (un)fair access, treatment, and exit.

The main strategies for inclusion in a service has been: to modify the user whose properties are not directly compatible with the system (cf [7]) and to modify the system environment that creates barriers for the user (cf [8]). The former is resolved by providing users with artefacts that facilitate the access to the service while the latter is addressed by designing the environment to remove barriers. Iterative co-creation approaches such as design thinking involve users in service design directly and have been successful in both the private and public sectors [9]. However, such approaches may not be fully practicable in highly regulated institutional environments that are financially constrained. Thus, institutional service designers require new analytical instruments to embrace the “diverse” user at critical service touch-points systematically and within their means.

This conceptual paper proposes a model-driven approach to detecting inclusion problems in university education as a special case of public institutional services. The aim is to expand the knowledge of inclusion problematics in service design to support decisions on its revision. The approach uses ontological and phenomenological perspectives as complementary to represent reality. A generic ontological model of inclusion in a service locates inclusion problematics in a basic service structure. It is then instantiated in a risk-aware goal model of a university course that connects the basic service structure to the inclusion problematics specific to its environment and users. The outcome is qualitative risk analysis of functional inclusion in a university course. The knowledge it enables us to see has been validated by expert opinion.
2 Inclusive Services in Literature

2.1 Inclusive Institutional Services

Creating inclusive institutions is one of the sustainable development goals on the Agenda 2030 [10]. Services can be seen as systems where inclusion can take place at the interface between institutions and the public. In [11], the authors propose an agenda for creating inclusive service systems by 2050, emphasising the need to understand service context, relationships, and interactions. A service is a value proposition [12] from a service provider to users and other stakeholders in the form of activities to solve their problems and meet their needs. Designing a service involves a structured and iterative process of understanding user needs and often includes modelling and analysing their divergent values. Services can have a “good” or a “bad” fit between their projected value and the value its users are able to extract. Institutional services are intended to support the social, economic, and political well-being of society as a whole. [4] defines inclusion as a measure of service quality since being usable by everyone equally means that its projected value can extend past the “average” user. Thus, service inclusion creates equitable opportunities for diverse citizen groups as users, making institutions societally sustainable [11]. Unlike those in the private sector, public institutional services are funded by taxes or other public resources and must adhere to stringent budgets. Thus, institutional resource allocation and prioritisation affect how they design and deliver inclusion. Furthermore, institutional services regulated by the government laws and policies, which may constrain or facilitate addressing inclusion. Interpretation of inclusion by institutional service designers determines its implementation [13].

2.2 Inclusive Education

The notion of inclusion in education has a complicated relationship with ideas of educational democracy and student diversity [14]. In the early 1990’s, policy initiatives targeted facilitating access to education for all students regardless of their characteristics [15, 16], further specialising the term “inclusive education” to students with disabilities [17]. Nordic countries are often viewed as a particularly interesting case of analysis [15, 16] as the so-called “Nordic model” promotes late differentiation and joint education of students with varying backgrounds [18]. The notion of social inclusion is strong in the history of education in Sweden [19] where inclusion is understood as legislative protection against discrimination on the grounds of social differences⁴ [20]. Within higher education, social inclusion has been connected to the goal of broadened recruitment [21, §5] as a point of fair access. However, social inclusion or fair treatment of those who have been admitted to studies has not been sufficiently operationalised although policy instruments exist (cf [22]).

⁴ Specifically, protected categories regard discrimination on the basis of gender, gender identity or expression, sexual orientation, religion, ethnicity, disability, and age.
Due to resource constraints, public universities may prioritise inclusion problems that are more tangible and thus easier to identify as well as favour solutions that are easier and less costly to implement. While useful and necessary, artefacts as inclusion solutions do not guarantee social inclusion of students with non-apparent disabilities such as ADHD and autism who rely on favourable social environments for supporting their function. Hence, actually securing accessibility and equal participation demands a critical analysis and a thorough restructuring of the organisation [23] including reconsideration of service design. Decisions about service design in education have focused on identifying non-average users and their characteristics as well as on determining the “limits to inclusion” [24], how they should be drawn, and by whom [25] to support the planning of resources. However, planning problems in education are wicked, meaning that there may not be right or wrong solutions, only better or worse ones [26]. Some service parameters cannot be decided upon once and for all [27] and there is a constant need for universities as service providers to reflect over how to attend to accessibility, participation, equity, and the quality of their courses and programmes.

2.3 Inclusive Services in Business Informatics

In business informatics, the term “inclusive design” is most frequently found in the literature on human-computer interaction [28] and design thinking [5] as well as in mixed-method studies [29]. These approaches employ user research to identify the needs and capabilities of diverse user groups to a nuanced degree, which then supports the development of accessible and responsive services. Since inclusive public services must be accessible to all citizens, the design need to consider an even broader range of users. Design thinking has been growing in the public sector [30] and can handle complexity [31]. However, due to unclear boundaries between the notions of “inclusive design” and “service design” [33], the method lacks structural integrity for representing complex contexts [32]. A broadened design agenda that emphasises the need for inclusion of diverse users has led to toolkits that embrace business modelling and “increasingly have less and less to do with design per se” [32, p.50]. Business modelling has been used to create sustainable value propositions [34], facilitate and enhance value co-creation [35], and align value propositions with societal needs [36]. However, business models may not properly represent service institutionality and social contexts [37, 38]. With this consideration in mind, we propose that business modelling can provide the vocabulary and architectural scaffolding needed to locate and concretise the inclusion problematics in the structure of institutional services, and thus can be a potent tool for supporting their design.

3 Our Modelling Strategy

To identify and analyse the inclusion problematics in a structure of a particular service, we represent it in two conceptual models that take an ontological and a
phenomenological perspectives. Although these views can be seen as oppositional (cf [39]), we use them as complementary which enables a more comprehensive analysis of reality than if they are taken on their own (cf [39, 40]). The ontological view seeks to identify, group and relate entities that exist or can be said to exist to clarify the structure of inclusion in a service. It provides a stable and objective architectural scaffolding to support the phenomenological analysis of the inclusion problematics pertaining to subjective human experience.

3.1 Ontological view

In information systems, ontological models are used for defining the structure, rules and semantics of a system (cf [41]). Web Ontology Language (OWL) and Unified Foundational Ontology (UFO) are technical notations tailored to the task. Our ontological model takes the form of a UML class diagram, a notation that was not intended for this purpose. However, we view the conceptual clarity it gives to the model as an advantage when demonstrating and discussing the model with educational experts who may be unfamiliar with conceptual modelling. We model inclusion problematics in a generic service (presented in Section 4) as an entity that exists for a particular purpose and follows a particular design that can change upon revision. The model is presented on a high level of abstraction and is domain-independent. It is based on existing research on service design and value proposition (cf [12, 4, 11]) as well as on our diverse perspectives and experiences as educators in public universities in the Nordics.

3.2 Phenomenological view

Qualitative, narrative-based phenomenological analysis rarely uses models. It dominates the field of user experience (UX) research where meeting subjective user needs creates business value (cf [42]). Focusing on the subjective experience is also recommended for designing institutional services that are inclusive of people with disabilities [43]. This study uses phenomenological analysis to uncover the mismatch between the environmental factors and user characteristics inherent in the service context under analysis. It takes the form of a goal model of the service that instantiates relevant classes of the generic ontological model to specialise the ontological view to the domain of application. The goal model is further expanded with qualitative risk analysis of how the mismatch may affect user experience, service goals, as well as service’s projected and extracted value. The risk analysis makes use of the RAMN notation [44] created for visualising risk in holistic business models. The inclusion problematics is specialised to functional inclusion in a university course, referring to a certain type of environmental barriers that may be experienced by students possessing characteristics of limited function.

Case The university course under analysis teaches research methodology to master students in computer and systems sciences at Stockholm University, Sweden,
at the conclusion of their studies. It was developed in 2020 and has been taught by two of the paper’s authors for the past three years. Our experience as course developers and teachers informed the goal model and its risk-aware extension. Particularly, the extension is based on continuous feedback on the study experience from new cohorts of about 100 students each year. In addition to formal course evaluations conducted at the end of each year, the feedback is gathered through informal interactions. As a result of the teaching staff’s common dedication to course development, student feedback reflects a favourable opinion of solutions we implement. However, despite these efforts, complaints regarding functional inclusion problematics continue to surface. These concern functional barriers as (a) **environmental factors** or functional limitations as (b) **user characteristics** that manifest when students engage in course activities: (a) “Course activities provide some students with unreasonable demands”, and (b) “Some students are not able to carry out course activities without unreasonable strain”.

In the disability discourse, “functional barrier” refers to the environmental factors that negatively influence a person with a functional impairment. We take a broader perspective and focus on barriers to functional inclusion for those individuals who may not have a disability but who may experience suboptimal levels of function, whether permanent or temporary, due to other conditions and states (e.g., chronic pain or grief) that are not considered disabilities and do not confer the right to functional support and accommodations. We refer to this as “functional variation” to differentiate it from “average function” of the “average student”. The ontological specification of the inclusion problematics in a service is as follows: (a) “Service environment presents functional barriers for some service users”, and (b) “All service users possess a characteristic of functional variation”. This inclusion problem relates to the goal of broadened recruitment and occurs after admission to studies.

### 4 An Ontological View of Inclusion in a Service

An ontological view of inclusion in a service locates the inclusion problematics in the design of a generic service and connects it to a decision-making layer in a public institutional context. The model consists of four consecutive parts: existing design, inclusion problematics, design revision, and new design (see Fig. 1). The numbers on the connectors between classes show how many objects within these classes can be connected by association, e.g., “0..*” means “zero to many”.

**Existing design** A service is offered to a user by a provider and has a more tangible desired outcome that is connected to a more abstract value proposition. The value proposition is aligned with the overall purpose of the public institutional establishment, e.g., universities work towards closing the skill and knowledge gaps. It can be specialised into projected value – something the provider intends to deliver to users and the society at large, and the value the user is able to extract from the service in practice. The latter can be compromised by an inclusion problem and may result in the purpose of the establishment not being
fully achieved for some user groups. It can also be supported by an inclusion solution. A use plan enables the user to engage with the service and includes activities to be carried out in a specific sequence, including by making use of various resources. An example of a use plan is a course plan that describes which activities the students need to engage in, in what order and to what effect. Finally, a service is delivered in a certain environment which can be physical such as a classroom in a building, digital such as a learning management platform, or social such as a group of peers and teachers.

Fig. 1. A generic ontological model of inclusion in the design of an institutional service.

**Inclusion problematics** Inclusion problems may arise when users experience challenges when carrying out an activity as part of the use plan. These chal-
Challenges, though beyond their control, may actualise as their user characteristics, e.g., having a permanent physical disability or feeling temporarily anxious. A user of a motorised wheelchair (user characteristic) can physically move from one place to another quicker than an average person (strength). However, having to take several flights of stairs to get to the lecture hall (an environmental factor) to attend a lecture (an activity) would highlight a limitation of not being able to do so and be a barrier, thus triggering an inclusion problem. However, for a student who enjoys good health and likes to be physically active (user characteristic), taking the stairs can be viewed as a facilitator to exercising a strength, and thus, no inclusion problem would occur. This example shows that inclusion problems are not solely inherent in either the user or the environment, and instead relate one or several environmental factors with one or several user characteristics. It is the mismatch between the factors and the characteristics that turns the former into barriers rather than facilitators and the latter into limitations rather than strengths, effectively hindering some users from extracting the service’s full value. The number of factors and characteristics that may come into conflict with each other is presumably enormous given the variation within them, the diversity of environments and users, as well as the differences in how the environments are configured and users are born and developed as humans. Consequently, it may not be feasible or practically useful to identify all possible combinations resulting in a mismatch to preempt them with a solution. Instead, we propose specialising the analysis to a particular service context and discover the causes of inclusion problems phenomenologically, i.e., basing it on the observable experience of service provision to delimit the problem and solution spaces.

**Design revision** The existence of an inclusion problem does not guarantee either its identification or that a solution is sought. Vice versa, if no inclusion problem is identified, it does not mean that none exists. However, once the problem is identified, it motivates revision of the service design. In public institutional environments, this revision evokes a decision situation where one or several decision-makers relate the problem to the law and policy regulating the service domain and the practice of the provider with the purpose to design a solution or conclude that no solution is required. In the model in fig. 1, the regulations are referred to as rules. The rules can be hard, i.e., mandatory to follow, and soft, i.e., to be followed whenever possible. Law and policy do not function on their own and can only be actuated through their interpretation in the human mind. Different decision-makers may have different interpretations of the constraints and the possibilities they provide as well as have different assessments of the problem. The interpretation can affect whether the inclusion problem can be acknowledged and addressed as well as restrict or enable the solution space. An inclusion solution follows the decision to include it in service design following the revision. It can be decided that no action should be taken due to the constraints laid out in hard rules, e.g., a requirement for a doctor’s certificate to prove the
legitimacy of the problem on the part of the user; or insufficient incentives for applying soft rules, e.g., a lack of institutional resources available for use.

**New design** The new design of a public institutional service can include three types of inclusion solutions, each to be implemented by actors at different levels of institutional hierarchy. An individual solution is about helping a certain user to overcome or mitigate the barriers in the environment by modifying the characteristics of that user, e.g., providing an individual hearing aid or helping with taking notes in class. Individual solutions can be implemented not only by the service provider but also by users themselves and their peers. A use plan solution focuses on modifying the use plan by changing it or including options of how an activity can be carried out, e.g., offering lectures as real-time on-campus events, video recordings, and transcripts so that they can be attended physically, watched remotely and read. Use plan solutions can be implemented by the service provider at a lower level of the hierarchy, e.g., teachers. Finally, an environmental solution involves changing the environment to reduce the number of barriers that can be experienced by some or all users, e.g., implementing universal design. Environmental solutions can be promoted by decision-makers at a higher level of the hierarchy, e.g., policymakers. After the new design is implemented, it becomes an existing design, and the problem analysis iterates.

5 **A Phenomenological View of Inclusion Problematics**

**Goal Model** For the generic ontological model to fit the domain of education, we specialise its classes as follows: Service to Course, Provider to University, and User to Student. Then, the class Desired Outcome is instantiated into Goals and Means which are determined by the service provider centrally. The means are further specialised into Strategies to represent activities or their modes and Policies and Rules to indicate what governs and constrains the Means as well as supports and compromises the Goals. Providing “Quality Education” is the top Goal and a specialisation of the class Projected Value in the generic model. It includes “Learning Outcomes” of the course together with “Pedagogical Alignment”. The classes Use Plan and Activity are instantiated through the Means of ”Creating Activities” such as attend lecture, read course literature, participate in seminars, and take exam – according to the course plan. The dimension of functional inclusion is represented through the Goal of “Functional Support” as part of the Goal “Support in Learning” under a higher-level Goal of ”Pedagogical Alignment”. There are two strategies for providing “Functional Support”: “By Request”, i.e., “do nothing unless the student states a request” and “By Design”, i.e., “accommodate functional variation in course development”. Thereby, the key components of the existing design part of the generic model have been adapted to the target domain.

**Qualitative Risk Analysis** The character of functional inclusion problematics in this course is modelled through environmental factors and user characteris-
tics as Influencers. The following categories of Influencers were included based on data about the course: “Student Characteristics”, “Teacher Assumptions”, “Teaching Culture”, “Teaching Resources”, “Course Management Prerogative”, “Regulation”, and “Compliance”. Further, the goal model is expanded with their Assessment constituting risk analysis\(^2\). Fig. 2 presents a fragment of the analysis where the Influencer “Student Characteristic” is assessed against the Strategy of “Providing functional accommodations by request”. Constrained by Policy, the Strategy can be implemented if students can provide a documented proof of eligibility. A risk indicator shows how this environmental factor puts students with certain characteristics at risk of functional exclusion. Accommodations may not be provided to the following groups of students: those who choose not to disclose their disabilities, have conditions that impact their function but are not considered disabilities, or do not have any conditions but experience temporary functional challenges. This knowledge is intended to support course designers and other decision-makers in considering solutions for functional support in course development.

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\(^2\) A complete model with searchable content can be downloaded at [https://shorturl.at/belqZ](https://shorturl.at/belqZ)
6 Evaluation of the Outcome of the Approach

The outcome of the approach and the viability of the instantiated model were evaluated by expert opinion [45]. Homogeneous purposive sampling [46] was employed to engage a small group of intended users of the model and the knowledge it provides – service designers with the power of organisational decision-making. The sample consisted of four Directors of Study at Uppsala University and Stockholm University in Sweden with expertise in managing study programmes on the doctoral, master’s and bachelor’s levels. Among them were three experts in Special Education (SE) and one in Regular Education (RE), representing the Department where the modelled course was offered – to validate if the model identified correct inclusion issues. The small sample size was motivated by the need to achieve data saturation rather than statistical power [47]. The data was gathered using unstructured 45-minute interview sessions [48] to discover their unique perspectives while limiting the researcher bias. It was recorded via note-taking after receiving the respondents’ consent. The data comprised a preliminary state of knowledge [49] and was not meant to create generalisations over the entire population of experts in similar professional roles. Rather, it provided an appropriate focus and an overview of the real-life concerns of this particular group of practitioners. We asked: Can the knowledge this risk-aware goal model produces be used for decision support about the design of your courses and programmes with the purpose to make them more functionally inclusive? If yes, then how? And if not, then why not?

6.1 Summary of Findings

A clear difference in perspectives could be seen between the service designers in SE and in RE. To the former group, the modelling approach presented a well-structured form of qualitative risk analysis. One respondent referred to the approach common for addressing inclusion issues as “a watering can”, meaning that a variety of different solutions are implemented simultaneously and unsystematically in the hope that at least some of them would work. All service designers in SE expressed that the model lifted and clarified the systemic inclusion issues that are important to address in their line of work but difficult to articulate otherwise. Possibly, this view can be attributed to the fact that educators in SE have a more nuanced view of the inclusion problematic, and therefore, appreciate it being made explicit. The service designer in RE, on the other hand, perceived the model as “too complicated and overwhelming for something that is so obvious”, meaning that the model did not provide new knowledge. The fact that the issues we identified were already known to Student Administration, confirmed the internal validity of the model.

Correctness of Service Representation The level of representation in the model – that of a university course – was deemed inappropriate. The universal character of the issues brought up in the risk-aware goal model led respondents
to conclude that the model could instead be drawn at a programme level or a higher systemic level, engaging policymakers and enabling solutions for all universities nation-wide. This suggestion can be interpreted as highlighting the need for universal design principles to address inclusion issues identified in a university course but also common on other levels and in other contexts. In the same vein, it was suggested by service designers in SE that a similar model could be created to analyse other types of inclusion problems such as language, age, and mobility. Some respondents expressed concerns that the model may not be taken seriously by some practitioners because it is based on multiple sources of practical knowledge rather than scientific data. Others stated that they mainly relied on tacit knowledge in their work, and risk analysis by modelling would not fit with their routines. The service designer in RE suggested that a process-view model could be more suitable because of the tradition of using process checklists by Student Administrators and Student Counsellors when processing students' requests for functional support.

Usability of the Approach Service designers in SE concluded that in their respective practices, inclusion problems are brought up during institutional meetings in the form of unstructured discussions. The approach was appreciated for the potential to provide structure, concretise non-apparent issues, and facilitate communication. Moreover, it was suggested that the approach could de-dramatise and de-personalise addressing inclusion issues in service development by making them more constructive, placing the focus on the inclusion problems at hand rather than actions of individual teachers. However, the approach was estimated to be time-consuming, both in terms of the time required to complete the modelling and to learn how to interpret the model. Nonetheless, service designers in SE concluded that they could see it being used once per term or once per year. Feasible usage scenarios were proposed such as creating a risk-aware goal model during a planning meeting to discuss resource trajectories and a workshop session facilitated by a modelling consultant. However, the service designer in RE did not see any usage scenarios for the approach in its present form in their line of work.

Understandability of the Diagram While the model was generally seen as having a clear structure, all respondents expressed the need for making it simpler and reducing the number of repeating elements. This problem could be accounted to the constraints of the modelling environment ADOxx that does not allow to hide supporting elements. In the RAMN library, Assessments of Influencers for impacts on other elements is visualised as one-to-one relationships which leads to Assessments being omnipresent in the risk-aware goal model. Although necessary for traceability, this feature provides a considerable amount of information noise and complicates understanding by practitioners not familiar with modelling. Some concepts like Assessment and Strategy were found confusing. It was suggested to substitute them for concepts that better reflected the reality of practitioners such as, for example, “Alignment”, “Instruction”, and “Barriers”
of learning, participation, and achievement. Some respondents expressed the need for a graphical element indicating that the list of Influencers is not exhaustive and can be expanded, while others mistook dependencies between the risk indicators and the course elements for causal relationships. These observations may indicate the need to introduce service designers to modelling notation prior to them working with the model. Finally, it was noted that it could be helpful for the model understandability to include indicators of responsibility for mitigating the risk of functional exclusion – to delineate the expectations imposed on service design (e.g., provide functional support) from the expectations imposed on students (e.g., disclose the need for functional support).

**Policy Compliance: Enabling and Constraining** All respondents referred to the requirement of broadening recruitment and participation of students [21, §5] as motivating the relevance of the approach to their line of work. Even though the issues the model showed were known to the service designer in RE, it was said that creating solutions in practice was either challenging or impossible because of the constraints imposed by the university policies centrally. One of such requirements obliges students to provide a documented proof of eligibility to receive disability support, which constrains functional inclusion to students with proven disabilities and diseases. According to the respondent, the requirement does not leave much room for accommodating those students who need other forms of functional support while not being able to provide a doctor’s certificate. A solution for this in the current service design is to make exceptions on a case-by-case basis, though such interventions are unsystematic and subject to resource availability. Therefore, addressing broadened recruitment and participation of students in service design in RE is both enabled and constrained by the internal university policy, which indicates a gap between policy guidelines and practical implementation possibilities.

7 Discussion and Conclusions

The model-based approach we have proposed and evaluated provides a new perspective on inclusion in a public institutional service. It bridges the gap in understanding service inclusion as an abstract problem that is too big and complex to solve and a practical problem that arises in the context of a particular service. By combining ontological and phenomenological perspectives, we clarify what it is and how it is experienced.

Domain-specific findings indicate that the approach responds to the needs of service designers in special education but is taken with scepticism in regular education. Given that higher education is not compulsory and access is based on merit, considerations of “special needs” is a relatively recent phenomenon. It is more common to consider the needs of an “average” student and build services around that persona rather than ask: Who are the individuals struggling? and What can we do for them? The new policy goal of broadened recruitment of students challenges this tradition and urges educators to broaden their view on
the problem and solution spaces to accommodate diverse students past the point of acceptance to studies. The generic ontological model of inclusion in a service can be instantiated in a variety of disciplines and subjects to support inclusive service design and development. The RAMN notation facilitates expressing in concrete terms the idea that environmental factors are neither intrinsically good nor bad but they can have different impacts on users with different characteristics. The diagrammatic depiction lets service designers become aware of the mismatch and how it can contribute to reducing the quality of service for some user groups, and thus, affect the extraction of service value.

While the approach does not offer solutions – something our respondents wished it did – it has the potential to ensure that non-apparent but pressing inclusion problems are not overlooked. Evaluation sessions let us conclude that the risk analysis enabled by the risk-aware goal model can be transferable to courses in other subjects, though the scale may not be suitable. It was determined that the inclusion problematics we revealed in a course may not be course-specific but rather, manifest at scale in study programs encompassing a number of courses. Service designers valued the stable analytical point of departure it provides when dealing with predominantly subjective and experiential systemic issues. Therefore, the approach should be applied on a programme level where the effort the analysis requires can be justified. For further validation of the approach, it should be tested in application to a different public institutional service that is deemed critical such as, for example, healthcare.

Public institutional services are helped and constrained by internal university policy that interprets national regulations. That which is stated explicitly may be followed through while that which is neither mandated nor prohibited may remain out of focus. Swedish institutional practice shows that broader interpretation of functional inclusion in services happens unsystematically through the efforts of individual universities (cf [50]). However, such efforts are difficult to propagate at scale as universities set individual priorities and work against individual budgets. Universal design is argued to hold the key for inclusive services, however, progress in that direction may need to be explicitly supported by policy guidelines. Therefore, another important direction for future research is investigating if a similar model-driven approach can support such guidelines.

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