Meet the demands of the future today with Universal Design for Learning (UDL)

Kamilla Klonowska[1], Eric Zhi Chen[2]

Kristianstad University, Sweden[1,2]

Abstract

The students' needs of support during their study years are changing, which is why the practices as educational developers and teachers are also changing. This article presents how Kristianstad University, Sweden, aligns with the European and Swedish regulations on broad recruitment. Furthermore, it shows the action taken by the Department of Computer Science to meet these demands and presents implementation of Universal Design for Learning (UDL) in two courses within the Software Development programme.

Keywords: *Universal Design for Learning, Computer Science, Higher Education, Student-Centred Learning, Active learning, Student Engagement*

1. Introduction

The European Commission's Eurydice Report [1] emphasizes that it is not enough to simply open the doors of our universities to ensure equal opportunities for all students. There is a need to actively improve the universities´ efforts to increase participation from a diverse range of students. To support this educational development, the European Union has agreed on European Standards and Guidelines (the ESG) presented in The European Association for Quality Assurance in Higher Education [2]. One of the ESG standards focuses on student-centered learning, teaching and assessment, particularly that the students play an active role in shaping the learning process and the assessment. Key aspects include motivation, engagement, self-reflection, flexible pedagogical methods and learning paths, as well as feedback on the students´ learning process [3].

In annual reports from Stockholm's University, Sweden, it is noted that the number of all students with disabilities in Sweden has rapidly increased over the last 10 years from about 10 000 to 32 000 students ([4], p.42). We could observe that e.g. between 2017 and 2018, there was 16% increase compared to 2016 [5]. Swedish universities can apply for grants for special pedagogical support for students with disabilities in the study situation. From the annual reports 2023 we find that the area od neuropsychiatric disabilities saw the most significant increase, makes up 38% of the student population who received targeted educational support. Dyslexia and specific reading and writing difficulties were the largest area, accounting for 40% of the student population who received access to support resources [6].

In comparison to the total number of students at each university, the percentage of students with disabilities varies between 2,5% and 9%. At Kristianstad University (HKR), which is the authors' home university, students with disabilities make up 4,4% of the total student population, amounting to 649 students with disabilities in the year 2023 [7].
To facilitate changes in our practice today for future requirements in line with the academic strategy, the Department of Computer Science at HKR applied Universal Design for Learning (UDL). This approach aligns teaching and learning with future-oriented mindset [8], [9].

2. UDL

According to Center for Applied Special Technology (CAST), UDL is "a set of principles for curriculum development that give all individuals equal opportunities to learn." It helps educational developers to teach teachers a concept that sees diversity as the norm and to teach accordingly [8]. Meyer et al. define UDL as "a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn." [10]. UDL is based on three core principles and associated guidelines. These are: (see also Fig.1)

1) Providing multiple means for **engagement** at each level of the course: This principle focuses on improving student's motivation and engagement, aiming for them to progressively take charge of their own learning motivation.
2) Providing multiple means for **representation**: This principle offers students the guidelines to acquire knowledge, helping them develop resourcefulness in their learning approach.
3) Providing multiple means for **action** and **expression**: This principle enables students to choose how to demonstrate their knowledge, fostering strategic and goal-directed learners.

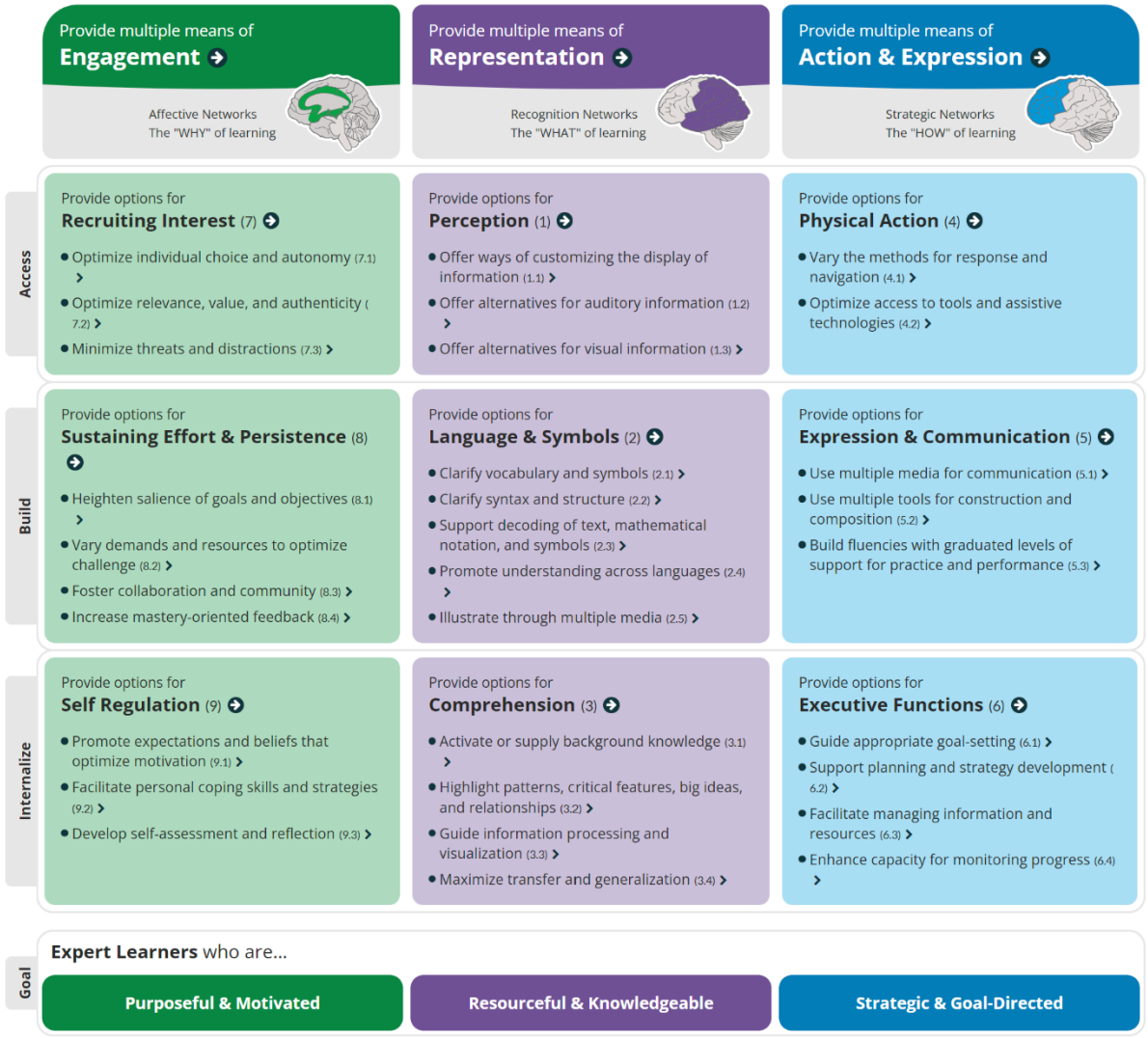

Fig. 1. Universal Design for Learning Guidelines [11].

The objective of all three principles is to help students improve their knowledge as well as to be more effective and self-directed. UDL aims to provide various ways for students to stay engaged and learn effectively, while also offering them multiple methods to express their knowledge. A significant aspect of UDL from the start has been the integragion of digital technologies to support these goals [10]. According to [12], a focus on subgroups becomes unnecessary when using UDL, as the framework prioritizes each individual as unique, even within a larger context.

For educators, every new framework raises the question of how to implement it effectively. Some good examples can be found e.g. in [13], [10] and [9]. CAST [13] also suggest starting the use of UDL by planning lessons, daily routines, or activities through a set of questions related to the three UDL principles, as well as providing good examples. Some examples are listed below:

1) **Engagement**: "*How can I engage all students in my class?*"
   Example: "State learning goals clearly and in a way that feels relevant to students." [13]

2) **Representation**: "*How can I present information in ways that reach all learners?*"
   Example: "Make it easy for students to adjust font sizes and background colors through technology." [13]
3) **Action** and **expression**: "*How can I offer purposeful options for students to show what they know?*"
   Example: "Provide calendars and checklists to help students track the subtasks for meeting a learning goal." [13]

3. Methodology

This research is conducted through few steps. European as well as University-wide regulations and changes are guided by reseach documentation. Changes to the programme, including courses contents and syllabi, are based on action research (diagnosis, planning, intervention, evaluation, reflection, [14]), where a group of teachers involved in the study discuss and refine the process during regular meetings. It is worth to mention that the course improvements are consistently based on student feedback. Lastly, two courses are presented: the first is a course for first-year students, and the second is a distance course open to all.

4. Results

4.1 University-wide Support

Kristianstad University (HKR) is a small but dynamic university in southern Sweden, which promotes an academic freedom, broad recruitment and broad participation, equal treatment, equality, internationalization and sustainable development. Additionally, HKR maintains values such as commitment, closeness and openness. The university fosters close relationship between educators and students, and supports students with various services, including the reception, the library, the chaplain, IT support and general services, study administration, learning workshops such as language workshop, literature search workshop, mathematics workshop, IT- and media pedagogical help, tutoring in study technology, all providing by the Library and Higher Education Development (BHP), HKR Innovation, International Office, the coordinator for students with disabilities, student health services, the student union, and study and career counseling [15]. Furthermore, HKR offers the following support for the students: note support; individual help with study techniques; mentor (for help with structure and planning); possibility to receive PowerPoints from the teachers; ability to receive PowerPoints in advance from the teachers; possibility to record the lectures with a dictaphone (or similar); talking books and other forms of adapted literature; spelling program and/or speech synthesis; help with academic writing; help with math; individual study plan (when full-time studies do not work); access to discuss questions about the course with teachers; extra tutoring by teachers if necessary (e.g. for writing tasks); extended writing time; possibility to write the exam on a computer; possibility to sit in a small group on the exam; possibility to sit the exam alone; possibility of supplementation; possibility of oral examination or oral completion; shared exam; possibility of alternative form of examination; clear feedback from the teachers on assignments and tests [16].

During 2015-2016 HKR conducted a project on First Year Experience (FYE) with the main goal of how HKR can improve the reception of students during their first time at the university [17]. The project has been carried out through focus group discussions with parts of the university's staff and a student questionnaire. In the report we find that several interviewees expressed a desire to work more with general academic skills, which they believe are essential for students' success in their studies. They mentioned that BHP is an important source of support for making students less "dependent on the individual teacher". Additionaly, the interviewees pointed out the importance of "being clear from the beginning" with what is expected, so that "they understand the level". Landgren discussed also the challenges of effectively introducing students to academic studies. Survey results shows that the first time at the university can, as one of the interviewees puts it, give "a rather confusing first impression", but also that it is important for the university to get the students on board early on what is expected of them during their studies [17].

During 2016, the HKR´s coordinator for students with disabilities initiated a project to introduce UDL in several of the university's programs to increase accessibility in teaching and, ultimately, reduce the need for special support. The educators had a possibility to attend the set of workshops as well as a

separate short pedagogical course on UDL. It was a shift in thinking and acceptance of students with disabilities in the courses. However, this new strategy not only benefited students with disabilities but also enriched the academic experience for all students, as evidenced by their feedback on the courses.

4.2 Program-wide Support

The Department of Computer Science at HKR has revised its education by adapting principles of UDL into course curricula and ensuring they align with HKR regulations. Today, each course syllabus includes the following statement: “If the student has a recommendation from HKR for special educational support due to disability, the examiner, or the examiner appointed, has the right to give an adapted examination or let the student complete the examination in an alternative way.” [18].

Through participation in UDL workshops, offered by the university, department members have refined their approach to meet present challenges and future needs, that include the diversity of todays’ students, their different disabilities, and backgrounds (e.g. cultural, knowledge, technique). This involves optimizing university resources, adapting curricula and assessment, and promoting flexibility and availability of teachers to support students who may lack study experience.

Additionally, to support students, the department employs senior students as teachers’ assistants in courses and as helpers for first-year students, organizing evening sessions and additional exercises, as well as organize various academic activities during the first week of their studies. In addition to above, other innovative activities have been integrated into the computer science programmes [19]. This study shows that students appreciate the continuation if these innovation modules. They felt the modules increased their understanding of the subject and improved their perception of their own skills.

4.3 A Campus Course -- Introduction to Computer Science (DA100D, 2023)

The Software Development students begin their programme with two 7,5 ECTS courses: Introduction to Computer Science and Fundamental Programming. Preparation for both courses are made through a collaboration between the responsible course coordinators for each course. Here, the course schedule and workload from the students’ perspective are discussed. This includes ensuring that examinations do not collide, allowing students to adequately prepare, maintaining a balanced workload of knowledge for each week, and considering the possibility of repetitions on the subject.

The Introduction to Computer Science [18] course introduces students with broad knowledge in computer science and prepare them for academic and scientific journey. In addition to covering computer science topics, the course also addresses applied computer science perspective and ethical considerations for programmers. Alongside the lectures that cover the computer science part, the course includes sessions on **academic skills**, such as information and literature search, source criticism, and academic-level report writing. Furthermore, guest lectures on “AI in computer science” and “Sustainable Development Goals and Ethical Aspects” are offered.

This course adopts a **flipped classroom** approach, where course materials in the form of power point presentations, review/homework questions, description of the exercises and seminars as well as study guide are available to students at the beginning of the course. To support academic writing, a variety of examples and templates are provided. This approach aligns with the **representation** principles of UDL.
The lectures prioritize discussions over traditional teacher-led presentations and problem-solving activities to foster **engagement** and **action**. For each course module, an online quiz is used for **formative assessment**, and the quiz statistics is used to identify possible problem among the students understanding, and to drive the class discussions.

Throughout the course, students work both individually as in groups. They collaborate on a group project, learning to write a technical report collectively, while also completing an individual academic report. The course emphasizes academic writing skills, peer review of reports, and group presentations during seminars. This early engagement in the academic process marks the students´ initial step into academia and fosters strong relationships among them. This approach aligns with the **engagement** principles of UDL. It is worth to mention that this course was one of two good examples

for engaging the first-year students during the pandemic time, presented on the FOE conference in 2021 [20].

To build a feeling of inclusion, the **communication** platform Discord is used to create study groups and communities. Discord is administrated by the senior students that help students not only with the course subject but answer on other questions do not relate to the course. This approach aligns with the **expression & communication** principles of UDL.

4.4 An Online Course -- Programming in C (DT555B, 2023)

The course Programming in C [21] is an introductory course on programming in C at introductory level. There is no prerequisite required to take the course. The course is delivered completely online. The participants have very wide spread of technical and cultural backgrounds. Most of the participants work or study in full time at the same time. So, an effective delivery is a big challenge. The UDL concept and various pedagogical methods are applied during the design and implementation of the course.

To let participants get to know each other when the course starts, and allow the instructor to know their backgrounds, a **presentation forum** is provided to allow participants to present themselves, quickly to know each other, and to facilitate the formation of the study groups. A **background survey** is also implemented to allow the participants to present information about their backgrounds and interests. With the background survey and the presentations, the instructor knows the students much better. When a student asked a question, the instructor could check the background and presentation to explain or to give the answer at a level he or she could understand.

To support the participants active learning, the various tools and arrangement are implemented: **discussion forum and messaging** to facilitate the online discussion and communications; online automatically graded **quizzes** are implemented as **formative assessment** for participants to self-check and evaluate their understanding on the corresponding contents.

To meet the different backgrounds among the participants, the course materials are developed to have multiple alternative forms for the participants to choose. For examples, the laboratory tasks are designed with multiple alternatives within different subjects and different difficulty levels for participants to choose. In this way, the participants could choose the one that they are interested and at the level they feel comfortable. In this way, the participants are motivated and become more engaged in their study by spending more time on it. The lecture slides, video clips, recommended text are provided for the participants to choose the form to study with. One participant expressed in the final course evaluation, " that there were so many different moments for learning: ppt, videos, books, exercises, labs and quizzes. All were good and complemented each other well (Att det var så olika moment för inlärning: ppt, videos, böcker, övningar, labbar och tester. Alla var bra och kompletterade varandra på ett bra sätt").

Besides multiple approaches for the course contents and delivery based on UDL, it is also important to emphasize the **flexibility, well-structured course contents and quick responses** to the participants in an online course. Due to widely spread backgrounds and available time, it is important to provide the participants with the possibility to learn at their own pace and time. Experiences showed that most students learned at their own pace, and they preferred to ask for help via messaging or email, so a quick response was quite important for the online course. For those who prefer synchronous communication, a weekly virtual office meeting was provided, so they could get instant help/support.

5. Summary and Acknowledgement

UDL offers a structured approach that facilitates systematic planning, argumentation, and clarity in courses and lessons, which leads to increased accessibility in teaching. By integrating UDL principles into the curriculum and teaching methods, the university can address potential challenges before they arise, leading to smoother academic journeys for students with varying needs.

This approach aligns with the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) and European regulations that universities must adhere to, including those related to broaded recruitment, inclusion and accessibility. By following these frameworks, the university not only fulfills its obligations under European guidelines but also supports the development of an inclusive and equitable educational environment for all students.

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