Redesigning Engineering Education for Neurodiversity: New Standards for Inclusive Courses

Dr. Maria Chrysochoou, University of Connecticut

Maria Chrysochoou is a Professor and Head of the Department of Civil and Environmental Engineering at the University of Connecticut. She obtained her BS in Physics at the Aristotle University of Thessaloniki, her MS in Environmental Engineering at Technische Universität Dresden in Germany and her Ph.D. in Environmental Engineering at Stevens Institute of Technology. She was hired as Assistant Professor at the University of Connecticut in 2007, promoted to Associate Professor in 2013 and Full Professor in 2019 . Dr. Chrysochoou's general research area is environmental geochemistry, with a focus on site remediation, characterization and reuse of industrial waste and construction materials. Dr. Chrysochoou's serves as the Principal Investigator of the project "Beyond Accommodation: Leveraging Neurodiversity for Engineering Innovation". Sponsored by the National Science Foundation Revolutionizing Engineering Department program, this 5-year project aims at transforming educational practices and cultivate the potential of neurodivergent individuals to contribute to engineering breakthroughs

Dr. Arash E. Zaghi, University of Connecticut

Arash E. Zaghi is an Associate Professor in the Department of Civil and Environmental Engineering at the University of Connecticut. He received his PhD in 2009 from the University of Nevada, Reno, and continued there as a Research Scientist. His latest research endeavor is on creativity and engineering education, with a focus on the unique potential of students with ADHD. Supported by multiple grants from the National Science Foundation, his research was highlighted the American Society of Engineering Education's Prism Magazine. He received a CAREER Award in 2016 to study the significance of neurodiversity in developing a creative engineering workforce.

Ms. Connie Mosher Syharat, University of Connecticut

Constance M. Syharat is a Research Assistant at the University of Connecticut as a part of the NSF Revolutionizing Engineering Departments (NSF-RED) project, "Beyond Accommodation: Leveraging Neurodiversity for Engineering Innovation". In her time at the University of Connecticut she has also worked as a Research Assistant for NSF CAREER project "Promoting Engineering Innovation Through Increased Neurodiversity by Encouraging the Participation of Students with ADHD" and has served as Program Assistant for the related summer program for middle school students with ADHD. Prior to joining the University of Connecticut, she spent eight years as a public school teacher in Connecticut, where she maintained a focus on providing a varied learning environment and differentiated instruction for all types of learners. She received her Master's Degree in Modern Languages from Central Connecticut State University in 2011. She earned her Bachelor of Arts in Hispanic Studies and her teaching certificate from Connecticut College in 2001.

Dr. Sarira Motaref P.E., University of Connecticut

Sarira Motaref is an assistant professor in residence in the Department of Civil and Environmental Engineering at the University of Connecticut. She has been teaching large classes such as CE 2110 (Applied Mechanics I) and CE 3110 (Mechanics of Materials) which are major requirement across multiple disciplines in the School of Engineering since 2013. She has led the efforts within the Department to develop and deliver flipped sections of undergraduate courses. She is a licensed professional engineer. She has attended several teaching workshops and received certificates from UConn CETL (Center for Excellence in Teaching and Learning) and NETI (National Effective Teaching Institutes). She is Winner of 2010 James D. Cooper Student Award at the International Bridge Conference, recipient of 2016 Klewin Excellence in teaching award and 2016 nominee for Mentorship Excellence Award from UConn office of undergraduates.

Prof. Shinae Jang P.E., University of Connecticut

Prof. Shinae Jang is Associate Professor in Residence and Director of Undergraduate Studies in the department of Civil and Environmental Engineering at the University of Connecticut (UConn). She joined UConn in 2010 after receiving her B.S. and M.S. from the Korea Advanced Institute of Science and Technology (KAIST) and her Ph.D. from the University of Illinois at Urbana-Champaign (UIUC). Prof. Jang's research interests include smart structures, structural health monitoring, wireless sensor networks, and engineering education. At UConn, she has taught 9 undergraduate courses and 2 graduate courses, including a new graduate course she developed based on her research in structural health monitoring and sensors. Prof. Jang is the recipient of the 2021 Distinguished Engineering Educator award from UConn, and the 2018 Civil Engineering Educator of the Year award from the Connecticut Society of Civil Engineers. She has served as the faculty advisor of the American Society of Civil Engineers (ASCE) UConn Chapter since 2012.

Prof. Amvrossios Bagtzoglou, University of Connecticut

Amvrossios (Ross) Bagtzoglou is Professor of Civil and Environmental Engineering at the University of Connecticut. He received his Ph.D. in Water Resources and Environmental Engineering from the University of California, Irvine. His research interests include hydrologic modeling, estuarine and river water quality management, geostatistical simulation and probabilistic analyses. His current research projects are: 'Evaluation of Grid Resilience Activities with a Total System Performance Assessment Model' funded by Eversource Energy, 'PIRE: Food and Water Security in Ethiopia' funded by NSF, 'Cooperative Hydrogeophysics and Water-Resources Research' funded by USGS, and 'RED Innovation beyond Accommodation: Leveraging Neurodiversity for Engineering Innovation' funded by NSF.

Ms. Caressa Adalia Wakeman, University of Connecticut

Redesigning Engineering Education for Neurodiversity: New Standards for Inclusive Courses

Abstract

Meaningful inclusion of neurodivergent students in engineering requires us to move beyond a focus on accommodations and accessibility and embrace a strengths-based approach toward neurodiversity. A large body of literature suggests that neurodivergent individuals, including those with attention deficit hyperactivity disorder (ADHD), dyslexia, or autism spectrum disorder (ASD) possess a wide range of unique strengths that may be assets in engineering. These strengths include divergent thinking, risk-taking, 3-dimensional visualization skills, pattern identification, and systems thinking. Despite the potential of nontraditional thinkers to contribute to engineering breakthroughs, recruitment and retention rates of neurodivergent students in engineering programs remain extremely low. The emphasis on conventional pedagogical methods in engineering programs, coupled with a deficit-based approach that is focused on the remediation of weaknesses, does little to foster the unique strengths of neurodivergent students. In addition to the obstacles posed by traditional education system, the stigma related to a disability label leads many neurodivergent college students to neither discuss their diagnosis with peers and professors nor obtain academic accommodations that may help them to persist in a challenging learning environment.

To address these challenges and realize the potential contributions of neurodivergent individuals to engineering fields, a research project funded by the Engineering Education and Centers of the National Science Foundation has been established to transform engineering education and create an inclusive learning environment that empowers neurodiverse learners. The project encompasses a wide variety of interventions in all aspects of academic life, from recruitment to career development. As part of the first iteration of the course redesign process, three pilot courses have been revised to address the unique strengths and challenges of neurodivergent students and improve the educational experience for all students. These redesigned courses in Statics, Mechanics of Materials, and Fluid Mechanics are fundamental engineering courses that are taken by a large number of students in a range of engineering majors including Civil and Environmental, Mechanical, Biomedical, and Materials Science and Engineering. This paper presents an overview of the implementation of a new framework for inclusive, strengths-based course design standards that were developed by engineering faculty along with experts in curriculum and instruction.

Traditionally, universal design standards emphasize aligning course objectives, learning experiences and assessments, explaining course information clearly, and using varied and accessible instructional materials. These universal design standards are adequate to provide courses that are accessible to all learners. However, to provide inclusive courses for neurodivergent students, additional standards are necessary to ensure that students can identify and use their unique strengths in an engineering context. The new framework expands upon universal design principles and provides guidelines that are anchored in a strengths-based approach and centered around three core elements: a culture of inclusion, teaching and learning, and instructional design. The application of the standards across the three courses has common elements (e.g., the ability to choose standard versus creativity-based assessments) and differences to reflect instructor style and course content (e.g., incorporation of design aspects in

more advanced courses). It is anticipated that the use of these standards will improve learning outcomes and enhance the educational experience for neurodivergent students.

Motivation

Neurodiversity is a term that has its roots in the autism activism of the 1990s. In recent years, the term neurodiversity has come to represent a wide range of cognitive or neurological variations that are present in the human population. A large body of literature suggests that neurodivergent individuals, including those with attention deficit hyperactivity disorder (ADHD), dyslexia, or autism spectrum disorder (ASD) possess a wide range of unique strengths that are assets in engineering. These strengths include divergent thinking, risk-taking, 3-dimensional visualization skills, pattern identification, and systems thinking [1]-[5]. Despite the potential of nontraditional thinkers to contribute to engineering breakthroughs, recruitment and retention rates of neurodivergent students in engineering programs remain extremely low [6], [7]. Furthermore, students with documented disabilities are significantly more likely to leave STEM fields than their peers without disabilities [8].

The emphasis on conventional pedagogical methods in engineering programs, coupled with the predominant deficit-based approach that is focused on the remediation of weaknesses, does little to foster the unique strengths of neurodivergent students. By reframing learning disabilities through a diversity paradigm and taking a strengths-based approach toward neurodiversity, program activities aim to empower these students to develop self-awareness, self-esteem, and self-determination [9], while cultivating their strengths for success within a STEM context. This strengths-based course redesign work was undertaken as part of an effort to radically transform the Civil and Environmental Engineering Department at the University of Connecticut (UConn) and was funded by a National Science Foundation IUSE/PFE RED grant through the Division of Engineering and Education Centers. The program aims to create a more inclusive learning environment for neurodivergent students, personalize the educational experience, and improve learning outcomes for all students.

Beyond Accommodations

To realize the potential contributions of neurodivergent individuals to engineering fields, the project is aimed at creating an inclusive learning environment in which all students can thrive. It is the position of the research team that meaningful inclusion of neurodivergent students requires us to move beyond the implementation of accessibility measures and adopt a strengths-based approach to acknowledge and cultivate the unique abilities and diverse thinking styles that these students possess. While there is scant literature on the implementation of a strengths-based approach toward neurodiversity in the context of engineering or other STEM fields, a review of the existing literature finds that this approach is promising to enhance the wellbeing and academic outcomes of neurodivergent students. One study found that a neurodiversity view was associated with expressions of greater career ambition and academic self-esteem [10], while the post-program survey responses of participants in a strengths-based Research Experiences for Undergraduates (REU) site, “Research Experience in Cyber and Civil Infrastructure Security for Students with ADHD: Fostering Innovation,” held at UConn under the leadership of a project Co-PI, showed that participants demonstrated increased self-confidence and interest in pursuing advanced degrees [11].

Team Structure and Activities

The process of course redesign was itself built to include a wide array of stakeholders, with a dual objective: to obtain feedback from experts and students in addition to the instructors, and to create a sense of joint ownership amongst the participants and the department. A group, self-identifying as the I-Team, was formed and included the Department Head, Associate Head, Environmental Engineering Program Director, Project Manager, and a group of four CEE faculty working on the first suite of courses. The faculty volunteered to join the team and were compensated with a stipend for their work. The Co-PI from the School of Education and a senior staff member from the Center for Excellence and Teaching and Learning (CETL) were also ad-hoc members of the team. The "I" in the team name and related terminology was chosen to reflect the focus on inclusion and to reinforce the idea of personalized education that takes into account the individual strengths and challenges of each student.

The I-Team work occurred in three phases:

The first phase that lasted through the spring semester included a series of biweekly workshops and discussions on neurodiversity. Topics included inclusive teaching practices, Universal Design for Learning (UDL), Center for Student with Disabilities operations and practices, and initial reflections from faculty on the objectives of course redesign. This stage of reflection and education culminated in the participation of the team in a Summer Institute offered by a private engineering college. In addition to attending workshops, the I-Team engaged with coaches in brainstorming sessions and a deeper dialogue on how to approach course redesign in a coherent way that could be replicated by colleagues in the future.

In the second stage of the process that occurred during the summer, the I-Team consolidated to the three faculty members that would work on course development for the fall semester, along with the Project Manager and Department Head. This smaller team also met biweekly and focused on the implementation of I-Course standards in the context of each course, with a peer-review taking place prior to the beginning of the fall semester. Finally, the third stage was to review and revisit the I-course standards both during and at the end of the fall semester, incorporating the acquired experience and feedback from students.

This model is now adopted as the annual process for review and revision of I-Standards and the development of more I-Courses. Presentation and discussion of the I-Standards is the first topic of conversation in the inaugural meeting of new I-Teams, setting the stage for further reflections and discussions. The course redesign process is further informed by the inclusion of student stakeholders in the project, namely, undergraduate and graduate students who self-identify as neurodivergent. Student contributors share individual experiences and perspectives to identify beneficial instructional practices and foster a personal connection with the faculty.

Introduction of the I-Standards

The I-Course Standards document resulted from the first stage of the I-Team process, emerging as a framework to guide the course redesign process throughout the life of the project. The I-Course Standards were inspired by the approach and format of Quality Matters, the certification system for online courses, which is adopted at the university for all online classes supported by the university teaching center. Several faculty members of the I-Team had previously worked with the center design coaches on online course development using the QM (Quality Matters) rubric and reported that the use of specific standards was particularly helpful with course design

[12]. The adoption of a rubric-style set of guidelines was therefore thought to be effective and familiar to many faculty members in the department with prior online course experience.

The I-Standards presented in this study are the result of two cycles of revision that took place during the fall and spring semesters, respectively. In the spirit of continuous improvement that is embedded in any standardization and accreditation process, the department envisions that the I-Standards will be critically examined at least twice a year during the life of the project, and annually as part of the ABET accreditation process. Broadening the scope of inclusive teaching practices to address multiple dimensions of student identity, such as race, gender, culture and others, has already emerged as a need for the next cycle of revisions. Here we present our current set of standards implemented in the first year of I-Courses.

Core I-Course Components

I-Courses are anchored by an overarching commitment to moving beyond accommodations and accessibility to embrace a strengths-based approach toward neurodiversity and cultivate the unique abilities and ways of thinking that are assets in STEM fields. Accordingly, the first theme in the I-Standards documents how the strengths-based approach is implemented in the context of the course. Placing the section at the beginning of the document is critical during the initial phase of I-Team work, when instructors are called to reflect on what they understand the strengths-based approach to be outside of existing frameworks. This process of eliciting initial ideas around an issue, followed by instruction and then refinement of these ideas to develop a practical application to the issue, is known as a High Leverage Practice (HLP) in science education [13]. This practice has been adopted as an effective paradigm in the context of training engineering educators, as well. In addition to the strengths-based theme, I-Course redesign standards were organized into three more core themes: 1) Culture of Inclusion, 2) Teaching and Learning, and 3) Communication and Supports. The three themes and the individual standards included in each are supported by the literature as elements that contribute to a more inclusive learning environment [14]. Certain standards are drawn from the literature related to effective practices that are documented to support student learning in general, such as active learning, while other standards specifically address the support, engagement, and sense of belonging of neurodivergent students.

A series of default interventions are implemented as part of all I-Courses. A modified syllabus is prepared to include both the standard accommodation language and a personalized inclusion statement. All course materials, including lecture slides and laboratory manuals are provided in accessible format. Recorded materials, such as lecture videos, instructor review sessions and TA recitation sessions are recorded and augmented with captions that are edited for 99.9% accuracy. During the first week of the semester, a short presentation about the INCLUDE project is given by the project manager and research assistant. These default interventions enhance the inclusivity of the environment, the accessibility of the course, and the learning experience for both the neurodiverse student population in particular, and the general student population overall. These, and other default interventions are discussed in further detail in subsequent sections.

While the I-Standards do require some baseline interventions, I-Course instructors have the flexibility to meet many of the standards in a variety of ways; the rubric is not entirely prescriptive. In alignment with our values, both teachers and learners should have flexibility to choose means of expression that best leverage their strengths. However, every standard must be met with an approach that passes peer review by other members of the working group to ensure that it meets the intended purpose.

We emphasize that these I-Course standards are not necessarily designed to address the specific needs of individual neurodivergent students, but rather, are compiled to create an inclusive, diverse and equitable learning environment as a whole. They are also not meant to replace detailed rubrics such as Quality Matters or the Universal Design for Learning framework. Rather, they serve as a nimble set of guidelines that faculty can adopt to personalize the learning experience through the incorporation of flexibility and student choice, while also empowering students to make the most of their strengths within the context of engineering courses.

Strengths-based approach

The strengths-based approach to education aims to help students identify, develop, and apply their strengths, so they can be used to encourage students, activate motivation, and accelerate learning [15], [16]. Recognizing one's strengths helps to promote social and emotional learning and aids in the development of self-awareness, self-management, social awareness, relationship skills, and decision making [16]. The overarching goal of the strengths based approach is to help students achieve [17] and promote a sense of well-being. It has been found that focusing on a student's areas of weakness reduces motivation to learn and puts students at risk for academic failure and depression, while a positive school environment is directly linked to well-being, engagement, academic performance, and can help bolster social and emotional skills [18].

However, a review of the literature indicates a knowledge gap in terms of the application of the strengths-based approach and its effects in the higher education environment. Most studies on the strengths-based approach have been conducted at the K-12 level rather than in postsecondary settings. Based on the existing literature, we developed three initial standard approaches. First, students are provided with at least one mechanism through which they can identify their strengths and challenges. Second, throughout the course of the semester, students are provided with in-class opportunities to reflect on their strengths and challenges, develop self-awareness, and engage in goal-setting activities related to their strengths and challenges. Third, students are given opportunities to *apply* and *articulate* their understanding of their strengths and challenges. When implemented in tandem with the tenets of Universal Design, the strengths based approach allows for alternative modes of measurement and provides aspects of individualization [19]. For some neurodivergent students who struggle with motivation, instruction designed from a strengths-based perspective may be particularly effective as it "begins with the basic premise that students will be more motivated to invest effort in learning when they are operating from a foundation of personal assets they bring to the learning environment" [20].

Culture of Inclusion

Many of the current inclusion efforts in engineering fields focus on increasing the participation and retention of women and underrepresented minorities. Within the context of this project, the concept of inclusion focuses primarily on the participation of neurodivergent learners who have diagnoses that have been defined through the medical model as a disability, a disorder, or a dysfunction. The INCLUDE program team has intentionally embraced a broad definition of neurodiversity that includes differences in sociability, learning, attention, mood and other mental functions that are sometimes related to health diagnoses. A few examples of the many expressions of neurodiversity include ADHD, autism spectrum, dyslexia, and anxiety. By focusing on the inclusion of students with a wide range of neurological variations, the learning environment becomes more inclusive for students with different strengths, challenges, learning habits, and ways of thinking. This allows for teaching that casts a broad umbrella for inclusion and has the potential to enhance the learning experience for all students.

The current version of the I-Course standards require that instructors intentionally build a culture of inclusion by: a) communicating their commitment to inclusion via a written or verbal statement to students, b) learning more about cognitive and other forms of diversity through workshops, readings, or other professional development opportunities, and c) reflecting on their current teaching practices and incorporating a variety of inclusive teaching practices. Such practices can and should address multiple student identities, including race, gender and culture, broadening the scope of inclusivity.

Inclusion Statements and I-Course Orientation

The research on neurodivergent college students shows that their perceptions of faculty attitudes toward their diagnosis and requests for support can have a direct impact on their academic success [14], [21]. In other words, when students perceive that faculty are more supportive and open to discussing their learning needs, these students are more likely to succeed academically. To address this need, I-Course instructors provide an inclusion statement that directly addresses neurodiversity, acknowledges strengths and challenges, and invites students to communicate with the instructor about these strengths and challenges. The statement may be provided orally, in writing as part of the syllabus, or in both formats. Rather than simply provide a standard statement, faculty are encouraged to personalize this statement. Model inclusion statements are provided in Table 1.

Table 1: Model inclusion statements.

Statement 1	I believe in creating an inclusive learning environment for all students and I value my students' unique ways of thinking and learning. If you are experiencing difficulties for any reason, or if you would like to talk about ways that we can help you to succeed in this course, please contact me or your TA.
Statement 2	I am a member of the INCLUDE program team, an NSF-funded neurodiversity initiative that aspires to create an inclusive learning environment in which all students can thrive. Emphasis is given to providing a strengths-based approach to education that encourages students to identify, develop, and leverage their unique abilities to address complex engineering problems. This course was designed to address the diverse ways of thinking and learning that neurodiverse students possess. Several pedagogical innovations will be implemented in this course including, but not limited to peer-learning, alternative examination modalities, project-based learning, etc.
Statement 3	As members of the INCLUDE program team, we aspire to create an inclusive learning environment in which all students can thrive. **We value and celebrate the diversity of our learning community in all of its forms, including race, color, religion, gender, gender identity or expression, sexual orientation, national origin, ability, age, or veteran status.** Emphasis is given to providing a strengths-based approach to education that encourages students to identify, develop, and leverage their unique abilities with the intention of supporting students in reaching their potential and enhancing their personal wellbeing. This course was designed to address the varied ways of thinking and learning that neurodiverse students possess.

In addition to the inclusion statement provided in the syllabus, a brief presentation is made at the beginning of each I-Course in which program staff and/or graduate assistant provide information about neurodiversity, strengths and challenges, screening tools, campus resources for academic accommodations and mental health and wellness supports. This very brief (5-10 minutes) orientation to the INCLUDE program provided basic introductory information about neurodiversity, campus resources, program activities, and the ways in which students might expect their courses to be enhanced by the course redesign process. The presentations were provided by the project manager and/or the graduate assistant.

Faculty Development/Instructor Training
As part of the bi-weekly I-Team meetings, instructors participate in development activities related to increasing their awareness and understanding of the educational experiences, strengths, and challenges of neurodivergent students in higher education settings. These faculty development activities include completing selected readings, dialogues with staff from the Center for Students with Disabilities (CSD), the School of Education, and the Center for Excellence in Teaching and Learning (CETL). Faculty also complete several modules of a disability awareness training centered around the first-person voices and experiences of students with autism, ADHD, anxiety, and traumatic brain injury. This training is provided through the School of Education.

Inclusive Teaching Practices
Prior to beginning the course redesign process, I-Team faculty complete an Inclusive Teaching Strategies inventory that is provided by the university's Center for Excellence in Teaching and Learning. Faculty reflect on their practices in terms of inclusive content, instructional practices, instructor-student interactions, and student-student interactions. In doing so, instructors are able to identify the strategies that they currently use, sometimes use, and would like to try. The reflection process thus informs future development activities of the I-Team and promotes integration of inclusive teaching strategies as part of the course design process. This inventory contains some content adapted from work done by both the University of Michigan Center for Research on Learning and Teaching (CRLT) and the Shrever Institute for Teaching Excellence at Penn State University [22], [23].

Teaching and Learning
This section of the I-Standards is focused on the various elements of course design: objectives, activities, materials and assessment. The section is anchored in Universal Design for Learning principles, which aim to increase the accessibility of the learning environment. By providing multiple means of representation, multiple means of engagement, and multiple means of action and expression, instructors build flexibility into instruction to minimize barriers to learning and meet individual needs [24]. Rather than depending on one-size-fits-all instruction designed for the typical learner, UDL builds flexibility into instruction and learning so that learners of all types can access materials, activities, and assessments that align with their particular needs.

Instructional Design
The standards specifically call out instructional design as a deliberate process that aligns these four elements and is subject to review by trained peers or staff from the Center of Excellence in Teaching and Learning. While this standard may be considered fundamental and obvious, it is a reality in higher education, and engineering in particular, that deliberate instructional design is rarely implemented.

Accessibility and Personalization
There is a broad range of UDL principles and levels of implementation [25]. Given the need to implement substantial changes in a short time frame and within the context of large college-level engineering classes, we narrowed down the principles to a smaller set that targets accessibility of content and personalization of activities and assessments. Specifically, the minimum standards for an I-Course call for multiple modes of accessible content delivery, adoption of assistive

technology where possible, and, more importantly, offering choices in terms of assessments forms or modes of delivery. An important component of the interventions is that students are asked to identify their strengths in choosing the preferred modes of interaction with the materials and activities, coming from a view of empowerment versus remediating a perceived disability.

Active Learning
Finally, active learning is selected as an effective teaching strategy that is particularly important in the context of engineering and other STEM fields [26], [27]. While some neurodivergent students may experience challenges with certain active learning strategies, such as cold-calling, group work, or the use of i-clickers, these activities may still be successfully implemented with some modifications such that these students have advance notice that they will be called to respond, the roles of group members are clearly articulated, or students have a longer time to provide their answer via an i-clicker, for example [28], [29]. Even with these sorts of challenges, in the context of a course that is thoughtfully designed with inclusion of neurodivergent students in mind, the hands-on, experiential nature of engineering work is particularly well suited to combine with active learning activities such as case studies and problem based learning. Additionally, it has been found that hands-on and problem-based activities such as those present in research and laboratory settings enhanced engagement and interest academic activities for students with ADHD [30]. The incorporation of social, economic and sustainability issues address recent changes in ABET student outcomes required by the program and enhances the focus on inclusivity and equity.

Communication and Supports
As part of efforts to enhance the learning environment, several standards were implemented to formalize and recognize the role of students as stakeholders in the course design process, build a safety net of supports for underperforming students, and provide social interactions that support student learning, and strengthen student-instructor relationships.

Students as Stakeholders
To center students as stakeholders in the educational experience, I-Course instructors incorporate a mechanism to collect student feedback on course activities and make efforts to incorporate this student feedback into the course. This feedback may be collected through a variety of ways, such as a brief electronic survey, a class suggestion board, or quick surveys collected on sticky notes for in-person classes, or via virtual sticky notes as in Google Jamboard or other similar applications. To provide meaningful changes in response to student feedback, collection of student feedback and instructor reflection and adjustment should be conducted at regular intervals. Faculty must provide regular and timely feedback to students in relation to their learning. To move beyond simply providing numerical grades, I-Course instructors also provide multiple modes of feedback to students to further enhance student comprehension [31]. This additional feedback may take the form of qualitative description of student progress, oral communications (i.e. brief meetings to discuss progress), or feedback from TAs or peers

Student Supports
It has been found that a high percentage of neurodivergent students do not seek services through their university's office for students with disabilities due to the overwhelming stigma related to the disability label, intrusive and expensive processes for evaluation and diagnosis, negative faculty attitudes about the intellectual abilities of students labeled as learning disabled, and perceptions that receiving academic accommodations is an unfair advantage [9]. Thus, many

neurodivergent students do not receive the supports that might help them to persist in a highly challenging academic environment [6]. To remove the burden and stigma of seeking such supports, I-Course instructors implement interventions in their courses that may help all students, regardless of their formal disability diagnosis or registration with the university Center for Students with Disabilities. Some of the practices implemented by instructors include the creation of study groups, reviewing student grades and reaching out to underperforming students via email, TA-led review sessions, 24/7 access to course instructional videos and materials (as in a flipped class), and clear communication of course due dates via a live, shared course calendar document (such as a Google Doc) that is regularly updated to reflect any changes to due dates and/or course activities. These interventions are supported both by the literature about neurodivergent student experiences and by feedback provided by neurodivergent student participants of the project advisory board.

Connections
Finally, I-Course faculty make an effort to be available for interactions with students via office hours (either in-person or virtual) and provide at least one additional opportunity for personal or social connections with their students. This standard may be met in a variety of ways, including FlipGrid video reflections, in-class games or discussions, or group activities that include a social component. These interventions are of particular importance and relevant to all students due to the changes in the learning environment caused by the global COVID-19 pandemic, as students have reported challenges with mental health, social isolation, difficulty concentrating, and lack of engagement in online courses [32], [33].

Introduction of Case Studies
The first three courses that were redesigned were the largest courses offered by the department. The Statics course is required across several program in the School of Engineering and has a yearly enrollment of approximately 500 students, taught in sections of ~120 students. Mechanics of Materials is also required across multiple programs and taken by ~400 students per year, taught in sections of 100 students. Finally, Fluid Mechanics is required for students in the department and offered as two sections of 60-70 students. As such, these courses target a large number of students in their sophomore and junior year, with Statics being the second course students take within the School after Fundamentals of Engineering in the freshman year.

The instructors of the three courses are experienced teachers with a strong commitment to the teaching mission of the university, and a history of implementing formal instructional design and state-of-the-art pedagogy. They were familiar with the content and existing activities of the courses, as all had already taught their respective course multiple times. Each faculty chose unique ways to tailor the standards to the course and aligned the rationale of the new or redesigned activity with one or more standards. The existence of the standards made the faculty think creatively and critically about the course redesign process, while adhering to a common set of principles.

Case Study 1: Applied Mechanics I (Statics)
Applied Mechanics I (Statics) is a required course for sophomores who major in Civil Engineering, Environmental Engineering, Mechanical Engineering, Biomedical Engineering, Manufacturing and Engineering Management, and Materials Science and Engineering. This course covers topics of basic engineering mechanics, including free body diagrams, force equilibrium, structural analysis, moment diagrams, friction, and moment of inertia. The format of

the course is an online flipped classroom with discussion sections. To fulfill the proposed I-Course standard, a series of default interventions have been implemented.

On top of the default interventions, other specific interventions were made for the Statics course based on specific course characteristics. Statics is a large course which focuses on physics and mathematics, meaning most of the course objectives are related to problem solving. The best way to improve problem solving skills is to allow students to create their own problems and prepare their solutions. Therefore, a strengths-based final project option was developed.

The final project was designed to allow students to learn Statics concepts more deeply with their own strengths. It serves as a replacement for the final exam and is worth 30% of the entire course grade. An anonymous initial survey about student strengths was given in the first lecture as an i-clicker quiz. The results were shared with students right after the survey. Based on the survey, two project tracks were offered: 1) problem solving track, and 2) creativity track. In the problem-solving track, students were asked to create 9 new problems and submit the solutions of each problem in either a written report or a video presentation. In the creativity track, students were asked to design a final deliverable that fulfills all course objectives. For both tracks, there were multiple required stages of the assignment including an initial letter of intent, submission of project proposal, a preliminary report, and a final report.

The students were given 4 weeks to complete the final project between midterm exam 2 and the final exam. In total, 51 students participated in the final project option, resulting in 45 projects. There were 40 individual projects and 5 group projects. Of these, there were 24 projects in the problem-solving track and 21 projects in the creativity track. The spectrum of creativity-track project topics was broad, spanning musical, visual, literal, and software programming domains.

To check the effectiveness of implementation of UDL principles in Statics, an additional question was included in the Student Evaluation of Teaching (SET) and students' feedback was sought. This additional question was "*Do you feel the I-Course activities and course modifications reduced your stress and helped your learning?*" Among 62 respondents, 59 reported yes and 3 reported no, suggesting that the implementation of the I-Course standard was positively accepted for that semester. This course is planned to be offered as an I-Course in Spring 2021 as a second iteration. More detailed interventions and SET results are reported in another publication [34].

Case Study 2: Mechanics of Materials

The Mechanics of Materials course is a major requirement for many engineering disciplines including Civil, Mechanical, Biomedical, Material Science, Management and Manufacturing Engineering, and Engineering physics. The class has large enrollments of 100 to 120 students per section and an annual enrollment of 400 students. Considering the limited faculty resources and available space, the flipped version of the class was developed in 2013 to enhance the quality of the course, share uniform resources to all students and provide alternative learning resources for diverse learners. The main objectives for developing this flipped course were to enhance the learning quality in large-enrollment classes and to promote inclusive teaching by providing online course content to all students.

A series of optional small strengths-based projects (SBP) were added to the course by asking students to contribute to the course based on their personal interests and expertise. Students were prompted to identify one or more areas of interest such as photography, drawing, filming, sports, programming, computer gaming, comedy, woodwork, cooking, planting, poetry, reading, and puzzles. Google Forms were used to enable students to identify their strengths and suggest a potential project. After students had identified their area of interest, the instructor assigned individual or group projects that were aligned with the student interests and course content. The participants created unique projects that are to be used as learning materials in the course. Students were able to submit up to 3 projects with a focus on topics covered in each class module. Participants were asked to complete a post-project survey to indicate the effect of strengths-based projects on enhancing the feeling of belonging, engagement, comprehension of concepts, class participation, and skill in applying concepts in real life examples.

Table 2: Summarizes student feedback.

SBP enhanced:	**Agree/Strongly Agree (%)**	**Disagree/Strongly Disagree (%)**
Feeling of belonging	94	0
Class engagement	100	0
Understanding of concepts	94	6
Applying concepts in real life	94	0
Class participation	76	6

In addition, students were asked to share their opinion about expanding strengths-based projects in all engineering courses and if it should be integrated as mandatory course components.

Table 3: shows a summary of students' response.

	Agree/Strongly Agree (%)	**Disagree/Strongly Disagree (%)**
Other engineering courses have SBP	88	0
SBP mandatory for all	71	6

Students expressed that participating in strengths-based projects enabled them to contribute something towards the classroom, as well as apply academic principals to real-life situations. Knowing that their projects will be used in future courses for demonstration purposes make them feel even more important and enhance their feeling of belonging within the engineering field.

Students reflected in their feedback that they were more creative with their ideas because they could choose projects which were aligned with their interests. It was observed by the instructor that a majority of the participants prepared and submitted their projects days before the deadline. This may be attributed to the fact that students did not consider SBP as a mandatory, predefined, and structured project. There was joy and satisfaction for the students involved in the process of creating a project.

Submitted projects were developed with extra care to be clear and understandable to peers, as students were told that their product will be used as a contribution to the course materials.

It was observed that some participants gained the self-confidence to express their ideas more often during class discussions. Such transitions in behavior can be explained by the impact of SBP on feelings of belonging and class engagement.

Conducting strengths-based projects demands time allocation, as it requires the faculty to work individually with each participant, provide feedback to each project, and meet with students. The large enrollment of the class and the limited human resources are obstacles to integrating this activity in the course for all students. Projects submitted by former students are stored and available in accessible folders so that current students can use them as learning materials. This folder will be expanded after each course offering, as the new projects will be added to this collection.

Case Study 3: Fluid Mechanics

Fluid Mechanics is a required course for juniors who major in Civil or Environmental Engineering. Occasionally, Mechanical Engineering and Biomedical Engineering students also take this course. This course covers basic fluid mechanics topics including hydrostatics, buoyancy, continuity, momentum and energy balance equations, pumps and turbines, Navier-Stokes equations, pipe network flows, and open channel flow. The course includes a laboratory component comprising four physical and two computational labs. The format of the course is a flipped classroom with in-person interactions whenever possible due to the pandemic. The enrollment for Fall 2020 when this course was implemented as an I-Course for the first time was 72.

Above and beyond the default interventions, specific interventions were made based on course characteristics. Concerns about students with grade and performance anxiety are addressed by building in flexibility that allows for three midterm exam grades to be over-written by the final exam if students so choose. Alternate exam modalities were also made available: an oral exam, a take home exam, and a design project exam. Lectures are live-streamed on Webex with opportunities for Q&A sessions. These lectures are also recorded. Videos showcasing the laboratory experiments being conducted are produced and captioned. Qualitative assessment of student performance is provided in a narrative form as a supplement to quantitative marks for all course components. Students write a reflection piece after each course unit in which they discuss challenges and how they will address them and provide suggestions on what the instructor can do better to address their needs.

The introductory reflection piece prompts the students to address the following questions related to the course interventions:

1. Even though it is still early in the semester, do you feel that the changes I described and made in the delivery of this class (lecture videos, TA/recitation videos, lab videos, live-stream with Webex, alternative exam modalities) will enhance your learning experience?
2. Which of these changes (mentioned in #5) do you think will have the most positive impact on you?
3. Out of the three alternative exam modalities (2-hr take home traditional exam, oral exam, design mini-project exam), which do you think may suit you better? I understand this is preliminary and by no means “cast in stone.”

A summary of the findings follows. 45 out of 51 students taking the course in Spring 2021 (88%) consider the INCLUDE project driven changes implemented as enhancing their learning experience. Out of the interventions implemented 24% ranked flexibility in test modality as the most significant, with lecture videos coming a close second (18%), and lab videos ranked third (10%). Overall feedback from students through the Student Evaluation of Teaching (SET) was positive, with 81% of the students judging the course as Excellent or Very Good and 80% of the students stating that they learned more or much more than their other courses. Some representative comments reflecting the course interventions are listed below in Table 4.

Table 4: shows the positive feedback received from students through the SET about their experience in the Fluid Mechanics I-Course.

Student	Feedback
Student 1	The instructor's ability to accept feedback and adapt to students' needs throughout helped to make the class better as it went on. The opportunities to recover from any bad exam with the final exam was really helpful and took off a lot of pressure, which I think made me do better.
Student 2	The instructor is very approachable and understanding with the challenges of online learning. He was extremely willing to change his teaching style to better fit his students' needs.
Student 3	The instructor was one of the most accommodating professors I have ever had.
Student 4	The instructor was very accommodating to online students and I had a fantastic experience learning, even online.
Student 5	I appreciated how you took the time to get everybody's opinion of the course after our poor performance on Exam 1. I think it made a huge difference.

Therefore, the implementation of the I-course standards is considered a success for the first time offering of Fluid Mechanics. This course is currently being offered as an I-Course (Spring 2021) as a second iteration with the following modifications that are based on lessons learned. We are testing the oral exam modality in a more widespread offering (only a handful of students chose it last fall). The design exam options are offered earlier and as an alternative to midterms as opposed to only for the final. Lab-oriented TA office hours are offered during the weeks when lab reports are due, and the students work closely with the TA as they finalize their reports. The students will write a strengths and challenges reflection piece at the beginning of the semester, which guides the assessment modality they pursue.

Discussion

While Universal Design for Learning principles are crucial in providing a more inclusive learning environment for students, the approach does not explicitly challenge the predominant viewpoint that neurodivergent students are disabled, disordered, or deficient. In contrast, the INCLUDE program unequivocally aims to embrace cognitive variations that may be an asset to STEM fields by reframing these variations through a diversity lens. Many neurodivergent students arrive in college having never heard that they might have strengths that can be assets in engineering and other STEM fields, as their prior educational experiences has focused primarily on the remediation of their weaknesses rather than in the identification and development of their strengths.

Initial data acquired via course feedback and surveys indicated that the interventions implemented as part of the INCLUDE course redesign process were well-received by students, and that UDL principles were successfully implemented in all three courses. While initial observations showed benefits to student learning and wellbeing, i.e. high levels of student engagement, motivation and performance on optional strengths-based projects and reduced anxiety due to flexibility in grading and assessment options, additional research is necessary to determine the impact of this and other implemented course interventions on student academic outcomes for neurodivergent students.

The observations from the first iteration of I-Courses are promising and have allowed the research team to begin identifying shortcomings and limitations. For example, it was noted that the focus on inclusion of neurodivergent students must incorporate a more clear vision for addressing the cumulative challenges faced by students living at the intersection of multiple marginalized identities. Future revisions of the I-Standards will highlight the addition of inclusive teaching strategies that acknowledge and celebrate student strengths related to diversity in all of its forms. It is anticipated that the team will seek opportunities for collaboration with other institutions whose inclusion efforts have centered around increasing the participation and sense of belonging of students who are underrepresented in STEM fields.

Summary and Conclusions

A strengths-based framework to enhance the inclusion of neurodivergent students in engineering courses was adopted in three large-enrollment courses in the sophomore and junior years. All courses implemented a set of default interventions that improved the accessibility of course content and materials. Beyond this, each instructor implemented additional interventions based on course characteristics.

Based on the data collected from student surveys and SETs over the course of the semester, several observations can be made. First, the data collected showed that a strengths-based approach offers many potential benefits to enhance the educational experience of students. Strengths-based activities can improve student engagement in learning, as shown by the high number of students who elected to complete optional strengths-based projects. Additional benefits reported by students include enhanced feelings of belonging, and enhanced ability to apply course concepts to real-world applications. However, it was observed that faculty should be cognizant of the time demands related to the implementation of strengths-based interventions, as the personalization of projects can require additional time for individualized feedback and significant time is required for the initial planning of such projects.

Finally, it was observed that several of the interventions, including built-in options for grading (such as replacing lower mid-term grades with higher exam grades) and providing choice of assessment modes implemented within the I-Courses supported the wellbeing and mental health of students by reducing stress and test performance anxiety. This observation is particularly noteworthy during the COVID-19 crisis, as students across the board are reporting high levels of stress and anxiety that can interfere with learning.

Acknowledgements

This material is based upon work supported by the National Science Foundation under IUSE/PFE:RED Grant No. 1920761. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

References

[1] L. Mottron, "Changing perceptions: The power of autism," vol. 479, *(7371),* pp. 33-35, 2011.

[2] E. A. Attree, M. J. Turner and N. Cowell, "A Virtual Reality Test Identifies the Visuospatial Strengths of Adolescents with Dyslexia," vol. 12, *(2),* pp. 163-168, 2009.

[3] R. D. Austin and G. P. Pisano, "Neurodiversity as a Competitive Advantage," pp. 96-103, 2017.

[4] L. Mottron, "Should we change targets and methods of early intervention in autism, in favor of a strengths-based education?" vol. 26, pp. 815-825, 2017.

[5] H. A. White and P. Shah, "Scope of Semantic Activation and Innovative Thinking in College Students with ADHD," vol. 28, *(3),* pp. 275-282, 2016.

[6] C. Cortiella and S. H. Horowitz. C. Cortiella and S. H. Horowitz. The state of learning disabilities: Facts, trends and emerging issues. The state of learning disabilities: Facts, trends and emerging issues. New York. New York. 2014.

[7] A. H. Showers and J. W. Kinsman, "Factors That Contribute to College Success for Students With Learning Disabilities," vol. 40, *(2),* pp. 81-90, 2017.

[8] C. D. Street *et al*, "Expanding Access to STEM for At-Risk Learners: A New Application of Universal Design for Instruction," vol. 25, *(4),* pp. 363-375, 2012.

[9] H. Denhart, "Deconstructing Barriers: Perceptions of Students Labeled With Learning Disabilities in Higher Education," *J. Learn. Disabil.,* vol. 41, *(6),* pp. 483-497, 2008. . DOI: 10.1177/0022219408321151.

[10] E. Griffin and D. Pollak, "Student Experiences of Neurodiversity in Higher Education: Insights from the BRAINHE Project," vol. 15, pp. 23-41, 2009.

[11] A. Hain, A. E. Zaghi and C. L. Taylor, "Board 164: Promoting neurodiversity in engineering through undergraduate research opportunities for students with ADHD," in *ASEE Annual Conference and Exposition,* 2018, pp. 1-10.

[12] Quality Matters, "Specific Review Standards from the QM Higher Education Rubric, Sixth Edition," 2020.

[13] T. Campbell *et al*, "JSTE as a Forum for Engaging in Knowledge Generation and Discourses in Science Teacher Education, Equity and Justice-Focused Science Teacher Education, and Professional Learning for Science Teacher Education Scholars," *Journal of Science Teacher Education,* vol. 30, *(5),* pp. 1-5, 2019. . DOI: 10.1080/1046560X.2019.1629220.

[14] A. C. Orr and S. B. Hammig, "Inclusive Postsecondary Strategies for Teaching Students with Learning Disabilities: A Review of the Literature," vol. 32, pp. 181-196, 2009.

[15] R. Galloway, B. Reynolds and J. Williamson, "Strengths-based teaching and learning approaches for children: Perceptions and practices," *Journal of Pedagogical Research,* vol. 4, *(1),* pp. 31-45, 2020. . DOI: 10.33902/JPR.2020058178.

[16] J. Bates-Krakoff *et al*, "Beyond a deficit model of strengths training in schools: Teaching targeted strength use to gifted students," *Gifted Education International,* vol. 33, *(2),* pp. 102-117, 2017. . DOI: 10.1177/0261429416646210.

[17] E. Anderson, "Strengths-Based Educating: A Concrete Way to Bring Out the Best in Students--and Yourself. The Confessions of an Educator Who Got It Right--Finally! The Quest for Strengths," *Educational Horizons,* vol. 83, *(2),* pp. 180, 2005.

[18] M. Bianco, D. E. Carothers and L. R. Smiley, "Gifted Students With Asperger Syndrome: Strategies for Strength-Based Programming," *Intervention in School and Clinic,* vol. 44, *(4),* pp. 206-215, 2009. . DOI: 10.1177/1053451208328827.

[19] S. J. Lopez and M. C. Louis, "The Principles of Strengths-Based Education," *Journal of College and Character,* vol. 10, *(4),* pp. 3, 2009. . DOI: 10.2202/1940-1639.1041.

[20] L. A. Schreiner, "Strengths-oriented teaching: Pathways to engaged learning," in *Paths to Learning: Teaching for Engagement in College*, B. F. Tobolowsky, Ed. Columbia, SC: University of South Carolina, National Resource Center for the First-Year Experience and Students in Transition, 2014, pp. 77-91.

[21] L. Clouder *et al*, "Neurodiversity in higher education: a narrative synthesis," *Higher Education,* vol. 80, pp. 757-778, 2020.

[22] A. R. Linse and S. Weinstein, "Strategies for Inclusive Courses Design an Inclusive Course Curriculum Curricular Transformation," 2018.

[23] CRLT, "Reflecting on Your Practice: Inclusive Teaching Principles in In-Person, Hybrid, & Remote Teaching," 2015.

[24] CAST, "Universal Design for Learning Guidelines version 2.2," 2018.

[25] K. Novak and K. Rodriguez. (-02-01T21:10:52+00:00). *UDL Progression Rubric*. Available: http://castpublishing.org/novak-rodriguez-udl-progression-rubric/.

[26] A. J. Cavanagh *et al*, "Trust, Growth Mindset, and Student Commitment to Active Learning in a College Science Course," *CBE Life Sciences Education,* vol. 17, *(1),* pp. ar10, 2018. Available: https://www.ncbi.nlm.nih.gov/pubmed/29378750. DOI: 10.1187/cbe.17-06-0107.

[27] P. Armbruster *et al*, "Active learning and student-centered pedagogy improve student attitudes and performance in introductory biology," *CBE - Life Sciences Education,* vol. 8, pp. 203-213, 2009. . DOI: 10.1187/cbe.09.

[28] L. E. Gin *et al*, "Is Active Learning Accessible? Exploring the Process of Providing Accommodations to Students with Disabilities," *CBE Life Sciences Education,* vol. 19, *(4),* pp. es12, 2020. Available: https://www.ncbi.nlm.nih.gov/pubmed/33001769. DOI: 10.1187/cbe.20-03-0049.

[29] K. Cooper, V. Downing and S. Brownell, "The influence of active learning practices on student anxiety in large-enrollment college science classrooms," *IJ STEM Ed,* vol. 5, *(1),* pp. 1-18, 2018. Available: https://www.ncbi.nlm.nih.gov/pubmed/30631713. DOI: 10.1186/s40594-018-0123-6.

[30] E. Zaghi, M. Tehranipoor and C. O'Brien, "Major observations from a specialized REU program for engineering students with ADHD," in *2016 ASEE Annual Conference & Exposition,* 2016, .

[31] T. Ryan, M. Henderson and M. Phillips, "Feedback modes matter: Comparing student perceptions of digital and non-digital feedback modes in higher education," *British Journal of Educational Technology,* vol. 50, *(3),* pp. 1507-1523, 2019. Available: https://bera-journals-onlinelibrary-wiley-com.ezproxy.lib.uconn.edu/doi/full/10.1111/bjet.12749. DOI: 10.1111/bjet.12749.

[32] Z. Meleo-Erwin *et al*, "Online support information for students with disabilities in colleges and universities during the COVID-19 pandemic," *Disability and Health Journal,* 2020.

[33] C. Son *et al*, "Effects of COVID-19 on College Students' Mental Health in the United STates: Interview Survey Study," *Journal of Medical Internet Research,* vol. 22, *(9),* 2020.

[34] S. Jang, "Re-design of a large statics course for neurodiverse students in the distance learning environment," *2021 ASEE Annual Conference & Exposition,* 2021.

Appendix A. I-Course Standards Draft

About I-Course Standards:

This document was created as a framework to guide the course redesign process of the CEE INCLUDE Working Group during the summer of 2020 and revised in 2021. This course redesign work was completed as part of the project funded by the National Science Foundation IUSE/PFE RED Grant #1920761. The INCLUDE program aims to create a more inclusive learning environment for neurodivergent students, personalize the educational experience, and improve learning outcomes for all students.

The CEE INCLUDE Working Group collaborated with educational design coaches, experts from the Center for Excellence in Teaching and Learning, and faculty from the Neag School of Education to create these standards for our I-Courses. I-Courses are anchored by a commitment to a Strengths-based Approach and centered around three core course features: **Culture of Inclusion**, **Teaching and Learning**, and **Communication and Supports**.

Strengths-based approach

Studies of strengths-based initiatives in higher education settings show that exposure to a strengths-based interventions can produce immediate positive short-term effects including increases in confidence, self-efficacy and learning breakthroughs (Louis, 2011). By incorporating awareness of student and faculty strengths into teaching and learning, it is hoped that I-Courses may enhance engagement, motivation, and persistence in the face of challenges (Schreiner, 2014).

Culture of Inclusion

Course instructor builds a culture of inclusion by a) communicating their commitment to inclusion via a written or verbal statement to students, b) learning more about cognitive and other forms of diversity through workshops, readings, or other professional development opportunities, and c) incorporating effective inclusive teaching practices throughout the course.

Teaching and Learning

Course instructor carefully considers ways to encourage student motivation and engagement by a) following principles of Universal Design to make the course accessible to all types of learners b) building in some elements of flexibility or choice that allow students to personalize their education to meet their learning needs and preferences, and c) providing opportunities for active learning that build in real-world problems and multidimensional considerations.

Communication and Supports

Course instructor a) centers students as stakeholders in the educational experience, b) provides scaffolding and/or other supports for student learning, c) provides multiple modes of feedback and communication to students about their learning and d) connects with their students and/or otherwise encourages a sense of belonging.

Standards	Strengths-based Approach	Provide evidence for each standard:
Identification	1.1 Students are provided with at least one mechanism through which they may identify their own strengths and challenges.	
Reflection	2.1 Students are provided with in class opportunities to reflect on their strengths and challenges and develop self-awareness. 2.2. Students engage in goal-setting activities related to their strengths and challenges.	
Application	3.1 Students are given opportunities to apply and articulate their understanding of their own strengths and challenges (for example, by making choices about their assessments or learning activities).	

Standards	Culture of Inclusion	Provide evidence for each standard:
Inclusion Statement(s)	4.1 UConn accessibility statement included in syllabus 4.2 Written personalized inclusion statement included in syllabus	
Faculty Development/ Instructor Training	5.1 Instructor educates him/herself about neurodiversity and strengths-based approach, including perusing selected readings provided by INCLUDE project, taking CETL inclusion and disability awareness training and other formats chosen by the instructor.	
Adoption of Inclusive Teaching Practices	6.1 Instructor completes Inclusive Teaching Practices Inventory 6.2 Instructor incorporates a variety of inclusive teaching practices throughout the course.	

Standards	Teaching and Learning (Universal Design)	Provide evidence for each standard:
Instructional Design	7.1 Course learning objectives, activities, materials, and assessments are aligned and articulated in the syllabus 7.2 Course design process is supervised by CETL or peer-reviewed by 2 other faculty with prior I-Course or CETL experience	
Accessibility	8.1 Students have access to a document (ideally a live document such as a Google doc) that is updated every week with actual schedule, changes to any materials/assignments, changes to any deadlines. 8.2 All class materials are available in accessible formats to accommodate different learning modes and strengths (i.e. class notes are provided in addition to slides, books with digital editions are chosen for ease of access, videos offer captions) 8.3 Suggested technology to enhance accessibility (speech-to-text, note taking assistance etc.) is included in syllabus with instructions for access and use	
Personalization	9.1 Course provides multiple forms of assessment (including exams, quizzes, homework, individual or group projects, term papers etc.) 9.2 Students have some choice of what assessments they complete or in what format they complete it (e.g. written report, oral presentation, video)	
Active Learning	10.1 Course includes opportunities for in-class active learning 10.2 Active learning activities have real-world applications that address different issues (e.g. social, economic, sustainability issues)	

Standards	Communication and Supports	Provide evidence for each standard:
Feedback	11.1 Feedback mechanism in place to collect student feedback (i.e. a class suggestion board or quick survey with sticky notes) 11.2 Course incorporates feedback from students at regular intervals 11.3 Course includes at least two modes of feedback to the student, such as narrative, oral, or numerical faculty feedback, feedback from TAs, or feedback from peers	
Student Supports	12.1 Faculty provide resources (in groups) for underperforming students (e.g. TA-led special help sessions, UTA-led review sessions, and referrals to CSD/MHW) 12.2 Faculty reach out to underperforming students to provide feedback and advice	
Connections	13.1 Faculty/Instructors are available for in person and/or online office hours 13.2 Faculty will provide at least one opportunity per semester for personal or social connection with and among their students, either in or outside the classroom setting, e.g. via FlipGrid reflections, in class games or discussions, or group projects that include social components	