Using the UN Sustainable Development Goals as a framework for developing critical thinking in relation to holistically sustainable architecture design projects for Architecture Students

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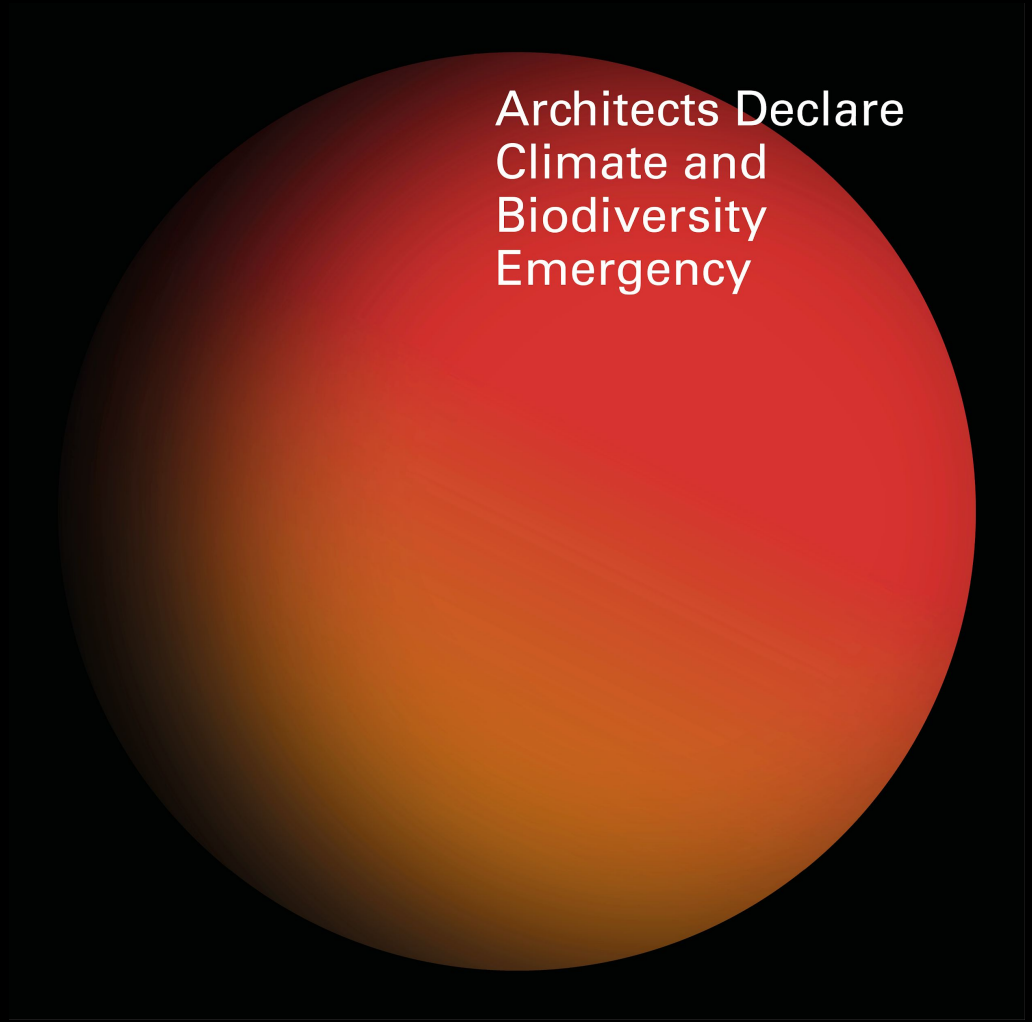

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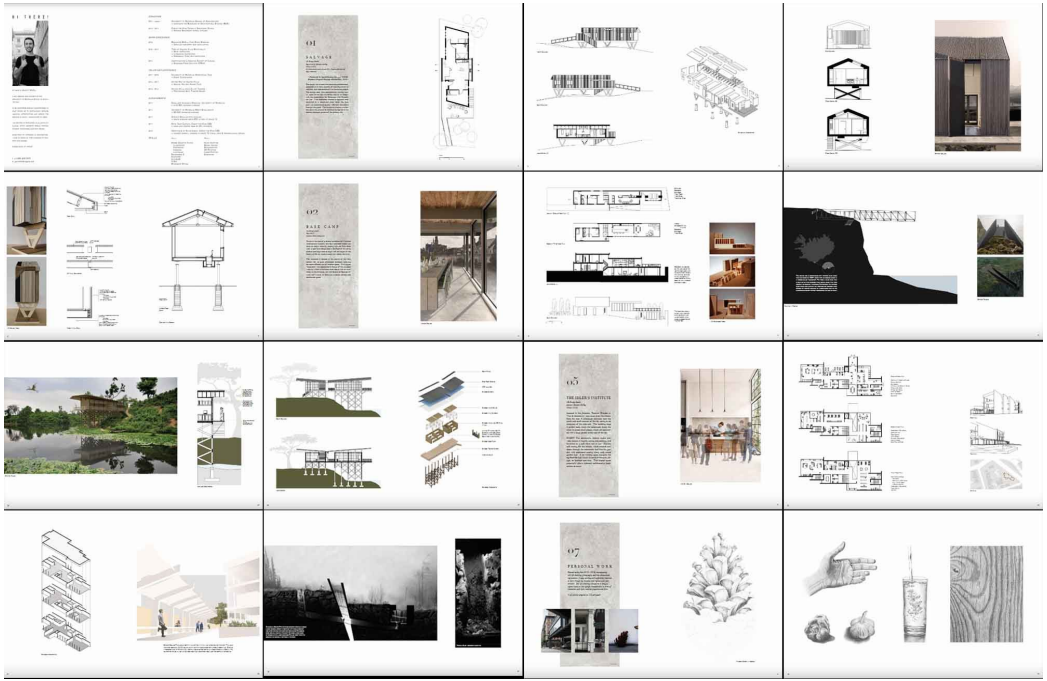
What is an architecture studio project?

- Students are given a site and develop a design brief from a client. E.g. Site: Ironbridge. Brief the student develops: A Community Centre procured by the local Council.

- They then develop a design solution based on the brief they have developed including the types of spaces and facilities (the programme of the building) they think the community centre should have.



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Comparing 2 approaches

- Integrated application: Students discuss which UNSDGs they are addressing in their design portfolio work, with an aim to address all of them.

- Integrated application through a sustainability matrix. Students state their key design strategies, which UNSDGs each strategy is addressing and where they show how they are addressing each of these, in relation to a design strategy, within their design portfolios.

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Sustainability shown to students within a framework helps them organise the complex information within a structure (Ausubel, 1960).

Architecture students are able to graduate with an understanding of holistic sustainability through a sustainability framework and show their future employers what they have learnt in relation to how these global goals can be addressed through architecture, **creating a clear message of what is meant by holistic sustainability (Knight, 2001).**

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- The two teaching approaches were designed to encourage students to show **which areas of sustainability they are addressing in their design portfolio work and show how they are addressing them through design strategies**, with an aim to look at sustainability holistically during a design process.

- This creates a **condition for learning** where students are **motivated to learn sustainability ideas** due to the direct application to their designs (Biggs, 1985).

- This approach is based on **cognitivism**, where learning is encouraged through critical analysis of the goals and **constructivism** by applying the goals directly to their work and ideas (Ertmer at al, 1993).

- This form of active learning can help encourage **critical thinking** (Kusumoto, 2018).

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Constructivist Teaching

- In order to introduce this task to the students, they were firstly **introduced to the concept of sustainability** and various sustainability frameworks recapped from Year 1.

- This **constructivist teaching** reminds students that the **various sustainability frameworks used by architects** overlap on key areas, but some have gaps, concluding that the UNSDGs covers all the areas of other frameworks with no gaps in key areas, making it a holistic sustainability framework that architects can use.

- This process is **justifying the pedagogical intent** to increase student understanding of the framework they are being asked to use and thus encouraging cognitive constructivism (Kalina and Powell, 2009).

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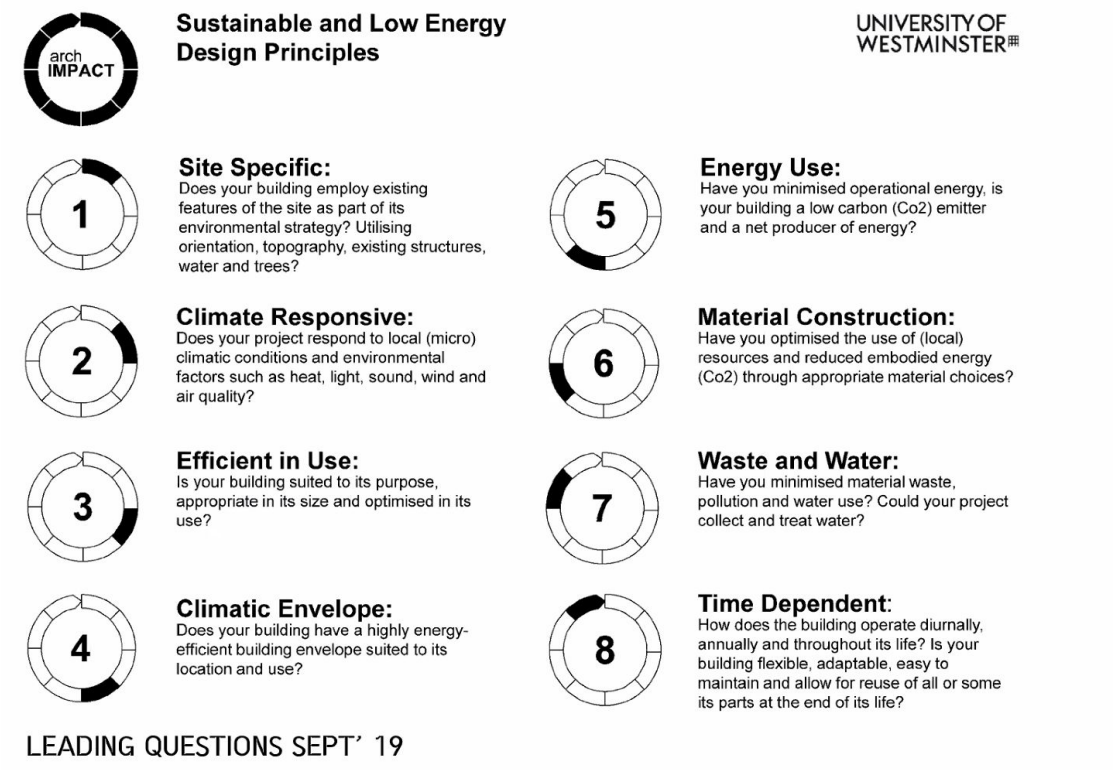
Making a unique sustainability framework



(Batty, 2021)

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Mixed methods used for analysing the two approaches

- The research conducts a mixed methods approach, analysing qualitative data (student portfolio pages) and quantitative data (the scale on the marking matrix given to students for the sustainability criteria).
- The **qualitative data analysis** will give an insight into the different ways students have applied sustainability to their projects by looking at examples of student work and how well they have analysed this in relation to their design ideas, giving a comparison of Approach 1 and 2. The qualitative data is a sample of portfolio pages taken from both academic years.
- The **quantitative analysis** will assess whether there is an overall difference in the marking matrix for the sustainability criteria for the two approaches, giving an insight into which approach has helped develop knowledge of applying holistic sustainability to their projects. Percentages of student marks will be compared for both academic years.

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Formative and Summative Feedback

- Feedback is given for how they have looked at sustainability by including this in the **marking matrix**, giving constructive alignment with the module teaching (Biggs, 1996).

ARCH5001 ARCHITECTURAL TECHNOLOGY 1 – FEEDBACK SHEET FOR ALL TASKS	Name of student:	Date:

FEEDBACK GRID:

	HIGH DISTINCTION	DISTINCTION	GOOD	FAIR	PASS	FAIL resit	No Valid Attempt
SUSTAINABILITY	Demonstrate an excellent and sophisticated understanding of the impact of the design proposal and the precepts of holistic sustainable design through the framework of the UNSDGs.	Demonstrate excellent understanding of the impact of the design proposal and the precepts of holistic sustainable design through the framework of the UNSDGs.	Demonstrate relevant and detailed understanding of the impact of the design proposal and the precepts of holistic sustainable design through the framework of the UNSDGs.	Demonstrate relevant understanding of the impact of the design proposal and the precepts of holistic sustainable design through the framework of the UNSDGs.	Demonstrate adequate understanding of the impact of the design proposal and the precepts of holistic sustainable design through the framework of the UNSDGs.	Demonstrate incorrect or incomplete understanding of the impact of the design proposal and the precepts of holistic sustainable design through the framework of the UNSDGs.	
E - PHYSICAL & ENVIRONMENTAL CONTEXT	Demonstrates a clear understanding of the physical and environmental context of the design project and is able to formulate fire safe and holistically sustainable design ideas which reflects this knowledge through thorough investigation and analysis.	Demonstrates a clear understanding of the physical and environmental context of the design project and is able to generate fire safe and holistically sustainable design ideas which reflects this knowledge.	Demonstrates an understanding of the key physical and environmental elements of the design project and is able to generate fire safe and sustainable design ideas which reflects this knowledge.	Shows some key physical and environmental elements of the design project and addresses some fire safe and sustainable design ideas which reflects this knowledge.	Shows some physical and environmental elements of the design context and shows some awareness of fire safe and sustainable design which reflects this knowledge.	Makes very few references to the physical and environmental context and shows very little awareness of fire safe and sustainable design which reflects this knowledge.	
E - ENVIRONMENTAL STRATEGIES	Clearly and accurately determines sustainable strategies and innovative technical design solutions which address comfort, delight, environmental impact as well as fire, thermal, acoustic, ventilation, lighting and building services strategies taking into account the brief and design concept at different architectural scales..	Clearly and accurately determines sustainable strategies and technical design solutions which address, as appropriate, comfort, delight, environmental impact as well as fire, thermal, acoustic, ventilation, lighting and building services strategies taken into account the brief and design concept at different architectural scales.	Clearly presented sustainable strategies and technical design solutions which address, as appropriate, comfort, delight, environmental impact as well as fire, thermal, acoustic, ventilation, lighting and building services strategies taken into account the brief and design concept at different architectural scales.	Generally developed some sustainable strategies and technical design solutions which address, as appropriate, comfort, delight, environmental impact as well as fire, thermal, acoustic, ventilation, lighting and building services strategies taken into account some design ideas yet fragmented and incomplete.	Generally outlines some sustainable strategies and technical design investigations which address environmental issues yet the work is fragmented, weak and unclearly related to the design concept.	Fails to explore environmental strategies in response to design ideas.	
S - STRUCTURAL DESIGN	Able to demonstrate full 3D control at different scales of a sustainable structural design solution that elegantly inform the spatial occupation, form and spatial aesthetics.	Able to demonstrate full 3D control of a sustainable structural design solution that elegantly informs the spatial occupation, form and spatial aesthetics.	Able to demonstrate in 2D a sustainable structural design proposal that aims to inform the spatial occupation, form and spatial aesthetics.	Able to demonstrate some form of sustainable structural design proposal with some attempt to inform the spatial occupation and/or form.	Vague structural knowledge presented - not very well explained nor developed.	No clear evidence of a structural design process	
C - MATERIAL SELECTION, DETAILING AND CONSTRUCTION	Clear ability to incorporate and select sustainable materials in accordance to the spatial design concept and to technically determine	Clear ability to incorporate and select sustainable materials in accordance to the spatial design concept and through precedent	Good use of sustainable materials selected in accordance to the spatial design concept and technically able to represent	Simple use of materials with attempts at defining the spatial design concept and demonstrates some knowledge of sustainable	Vague or no use of materials to define the spatial design concept and demonstrates little knowledge of sustainable materials. Technical ability is low	No evidence of selected materials nor sufficient technical details to explain the design intentions.	

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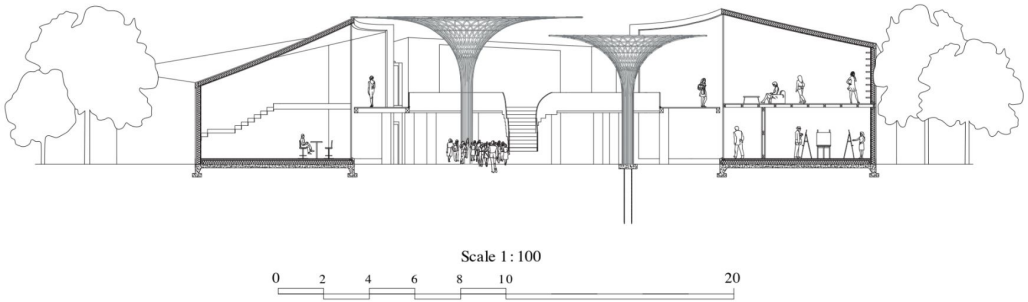
Results of qualitative analysis - Approach 1

Student architecture project portfolio page showing how some UNSDGs have been addressed through design ideas. The student is demonstrating a sustainability goal that a design strategy is addressing. What is limited here is that some strategies address more than one goal, highlighting the benefit of a matrix with codes for each design strategy and the goals they address.



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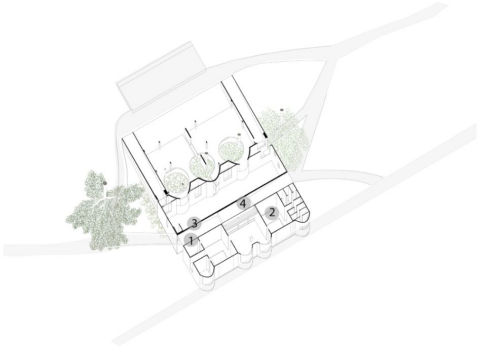
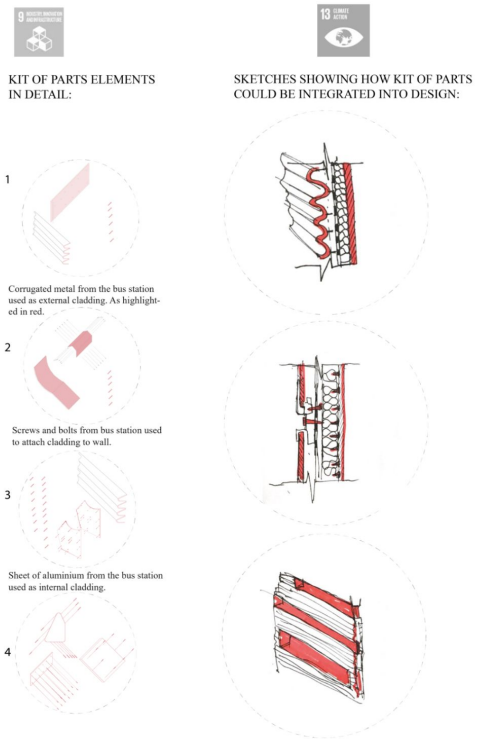
Results of qualitative analysis - Approach 1

Student architecture project portfolio page showing the SDG logos but it isn't clear in what way the kit of parts addresses climate action. In this case, the student could include a brief annotation and arrow pointing at the element(s) that addresses climate action.





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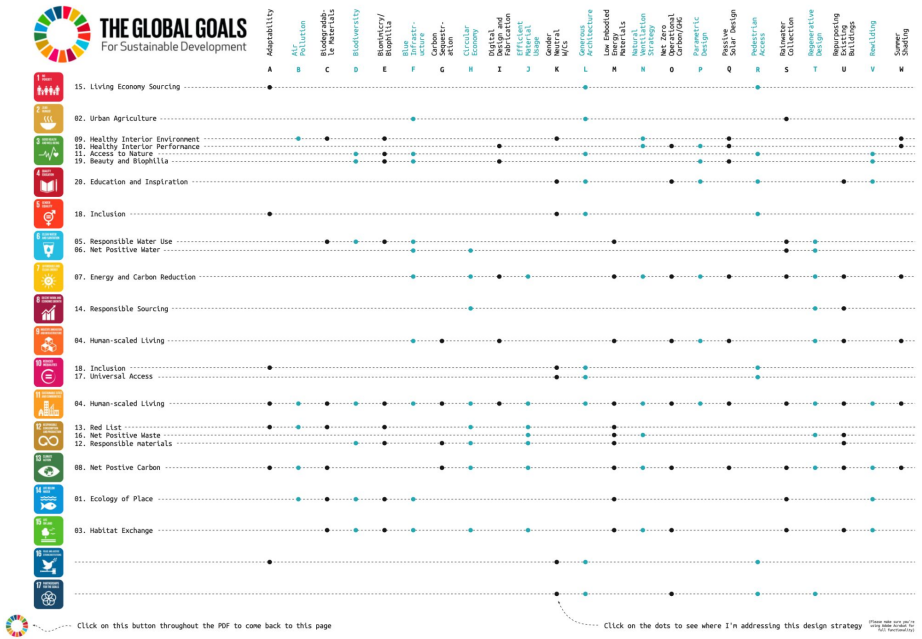
Results of qualitative analysis - Approach 2

Student architecture project portfolio pages showing the sustainability matrix with their key design strategies and which UNSDGs these strategies are addressing (a code created for each dot).



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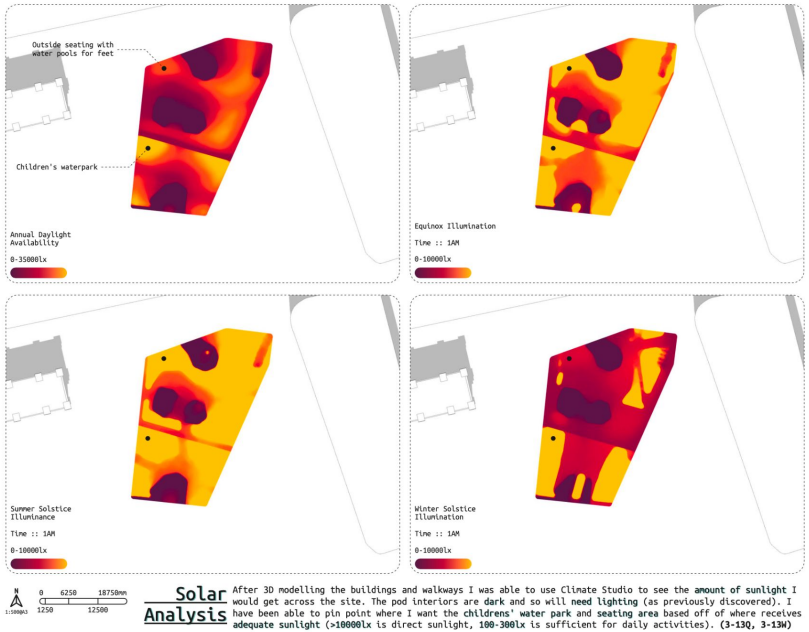
Results of qualitative analysis - Approach 2

The student shows how each of these codes are addressed by including the codes within their design portfolio page annotations.

This student created an interactive pdf where clicking on a dot takes you to the page that this code is shown. This student has fully understood the task to show which goals are addressed in their design project and how they are addressed.



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Results of qualitative analysis - Approach 2

The two examples above show students linking the sustainability codes developed with key pages within their portfolios.

This method is helpful to direct us to relevant pages.

If the images on the images are self explanatory in relation to how they meet the goals, this method works well, however if it's difficult to understand where the page is showing how a goal is addressed then the code should also be included on relevant images within a page.

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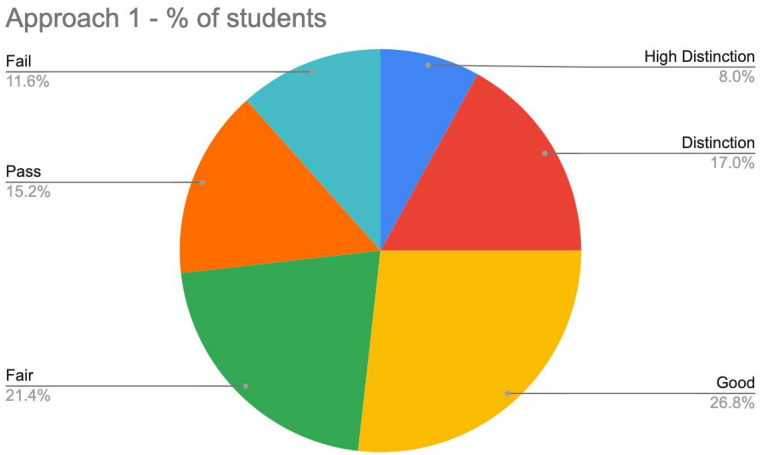
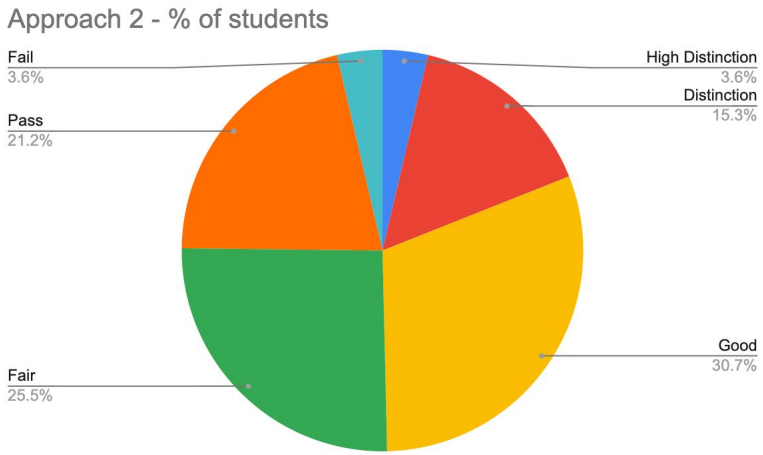
Results of quantitative analysis - Approaches 1&2 marking matrix results for sustainability





This comparison shows that Approach 2 had a higher percentage of students being able to demonstrate understanding of holistic sustainability in relation to their design projects, giving some insights that the approach was able to help students show a good understanding of holistic sustainability.

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Conclusions

- The analysis has shown that Approach 2 is a step in the right direction with regards to demonstrating direct application of holistic sustainability linked with design ideas.

- The task of applying the UNSDGs to design portfolios can give some students a lot of enthusiasm and a challenge to think about sustainability holistically, as well as in contrast, make some students feel the task is too complex (Yarborough et al, 2020).

- This highlights the importance of further integrating in the teaching methods for helping students understand that it is a challenge that everyone in the industry is facing and that we don't expect them to have perfect solutions, but they have shown a critical analysis and application to their work.

- This is part of the road map to implementing sustainability in the School of Architecture programmes.

References

- Ausubel, D. P. (1960). The use of advance organizers in the learning and retention of meaningful verbal material. Journal of educational psychology, 51(5), 267.
- Batty, S. (2021) ACAN Education Workshop 2, Educators Collaboration Forum, Presentation by Scott Batty from the University of Westminster, School of Architecture, Date Workshop attended: 7th April 2021
- Biggs, J. (1996). Enhancing teaching through constructive alignment. Higher education, 32(3), 347-364.
- Biggs, J. B. (1985). The role of metalearning in study processes. *British journal of educational psychology*, *55*(3), 185-212.\
- Ertmer, P. A., & Newby, T. J. (1993). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance improvement quarterly*, *6*(4), 50-72.
- Kalina, C., & Powell, K. C. (2009). Cognitive and social constructivism: Developing tools for an effective classroom. *Education*, *130*(2), 241-250.
- Knight, P. T. (2001). Complexity and Curriculum: A process approach to curriculum-making. Teaching in Higher Education, 6(3), 369-381.
- Kusumoto, Y. (2018). Enhancing critical thinking through active learning. *Language Learning in Higher Education*, *8*(1), 45-63.
- Leal Filho, W., Shiel, C., Paço, A., Mifsud, M., Ávila, L. V., Brandli, L. L., ... & Caeiro, S. (2019). Sustainable Development Goals and sustainability teaching at universities: Falling behind or getting ahead of the pack?. *Journal of Cleaner Production*, *232*, 285-294.
- Mills, D., & Alexander, P. (2013). Small group teaching: a toolkit for learning. *Higher Education*, *36*.
- Norton, L. (2009). *Action research in teaching and learning: A practical guide to conducting pedagogical research in universities*. Routledge.
- RIBA. (2021) Mandatory Competences, Royal Institute of British Architects. Accessed November 2021: https://www.architecture.com/knowledge-and-resources/resources-landing-page/mandatory-competences
- UN (2015). Transforming our world: the 2030 Agenda for Sustainable Development A/RES/70/1. https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf
- UNESCO (2019) SDG 4 - Education 2030: Part II, Education for Sustainable Development beyond 2019. https://unesdoc.unesco.org/ark:/48223/pf0000366797
- Weber, J. M., Lindenmeyer, C. P., Liò, P., & Lapkin, A. A. (2021). Teaching sustainability as complex systems approach: a sustainable development goals workshop. *International Journal of Sustainability in Higher Education*.
- Yarborough, C. B., & Fedesco, H. N. (2020). Motivating students. Vanderbilt University Center for Teaching. Retrieved [todaysdate] from https://cft.vanderbilt.edu//cft/guides-sub-pages/motivating-students

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