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Data Descriptor

A Survey Dataset Evaluating Perceptions of Civil Engineering Students about Building Information Modelling (BIM)

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Abstract: The implementation of Building Information Modelling (BIM) technologies has become increasingly central in the design, construction and maintenance of both civil structures and infrastructures. As more and more software houses develop new BIM software solutions and a wide range of private and public stakeholders employ them, several educational institutes across the globe strive to expand their teaching portfolio to encompass learning and teaching of BIM. This dataset deals with the perceptions expressed by all the civil engineering undergraduate students who attended an academic course specifically about BIM at University of Stavanger (UiS), Norway, during the second semester 2022. The survey was divided into five parts and collected information regarding as many overarching aspects: socio-demographic data, perceptions about BIM before and after course attendance, satisfaction about the academic course and the way it was conducted. Considering the very moderate sample size (28 students) and potential biases due to the specific context of the University of Stavanger, the dataset can provide a useful insight into teaching approaches and future curriculum development, rather than indicating major and generalized trends in BIM education. As the questionnaire responses shed light on the feedbacks and perceptions expressed by university students dealing with BIM for their first time, the formed dataset can offer a straightforward appreciation of students' cognitive behaviour in BIM education.

Dataset: Perceptions of civil engineering students about Building Information Modelling (BIM). https://data.mendeley.com/datasets/sb8yhb3ppw.

Keywords: building information modelling; civil engineering; university education; survey data; student perceptions

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1. Summary

The dataset described in this work is "Perceptions of civil engineering students about Building Information Modelling (BIM)" (https://data.mendeley.com/datasets/sb8yhb3ppw accessed on 6 May 2023) [1], which contains the information collected from a web-based survey administered to all the 28 civil engineering undergraduate students attending the academic course about BIM "Construction Management—BYG230" ("Byggadministrasjon med BIM—BYG230" in Norwegian) at University of Stavanger (UiS), Norway, between September 2022 and November 2022. The motivation for performing this survey

stems from the central relevance that BIM implementation has exponentially acquired in the civil engineering sector during the last decade. As more and more software houses develop BIM technologies which are largely employed by private consultants or public agencies to meet the stringent requirements defined in projects and megaprojects, the goal of higher education is to offer an updated and attracting BIM education. Furthermore, the first adoption of BIM approach took place in the Nordics among the others, with Norway showing a widespread distribution among professionals. The overarching motivation behind the creation of this dataset is two-fold: (i) display the perceptions expressed by university students specifically dealing with BIM education and (ii) indicate how the content of BIM education can be improved or even tailored based on students' viewpoints.

2. Data Description

The purpose of the course "Construction Management—BYG230" ("Byggadministrasjon med BIM—BYG230" in Norwegian) run at University of Stavanger (UiS), Norway is to deliver the students theoretical and practical knowledge about BIM concept and implementation in civil engineering. Furthermore, five digital tools that are largely employed in Norway are illustrated in the course and used in exercises. These five BIM softwares are Autodesk Revit (for architectural design), Autodesk Dynamo (for visual programming), ISY Calcus (for cost estimate), ISY Beskrivelse (for material inventory creation) and Solibri (for clash detection).

The collected survey dataset is publicly available on Mendeley Data (https://data.mendeley.com/datasets/sb8yhb3ppw accessed on 6 May 2023) [1] and stores two files: "Survey text.pdf" and "Survey dataset.xlsx" (containing just one spreadsheet with the title "Survey dataset"). The former file contains the English version of the 21 questions (Q) contained in the questionnaire (Table 1) which was administered to the students between September 2022 and November 2022. The survey is divided into five parts. Part 1 (4 questions) asks main demographic information (age, gender, county of origin and study direction). Part 2 (4 questions) and Part 3 (4 questions) deal with the students' opinions regarding BIM before and after attending the university course BYG230, respectively. It is important to stress that Part 2 was filled by the survey respondents during the first week of September 2022, namely before the start of the course. Part 4 (6 questions) investigates respondents' opinions related to the different software and digital tools illustrated during the course as well as the students' curiosity towards BIM. Part 5 (3 questions) maps the satisfaction of the students regarding the way the university course BYG230 was conducted. Except for Part 2, all the other parts (Part 1, Part 3, Part 4, Part 5) where administered at the end of the course, namely during the last week of November 2022.

Table 1. Survey structure.

PART 1—SOCIO-DEMOGRAPHIC DATA
Q1.1 Age (open answer)
Q1.2 Gender (choose one: male, female, other)
Q1.3 Which county are you from? (choose one: Rogaland, Agder, Innlandet, Møre and Romsdal, Nordland, Oslo, Vestfold and Telemark, Troms and Finnmark, Trøndelag, Vestland, Viken)
Q1.4 Which is your BSc study direction? (choose one: construction engineering (1), urban planning (2), technical planning (3))

Table 1. *Cont.*

PART 2—YOUR PERCEPTIONS ABOUT BIM BEFORE ATTENDING UNIVERSITY COURSE BYG230
Q2.1 How would you rate your awareness of BIM? (choose one: extremely low, very low, low, average, high, very high, extremely high)
Q2.2 How would you rate your interest in BIM? (choose one: extremely low, very low, low, average, high, very high, extremely high)
Q2.3 How would you agree with this sentence: knowledge about BIM can provide better job opportunities? (choose one: extremely low, very low, low, average, high, very high, extremely high)
Q2.4 How would you rate your expectations about the university course BYG230? (choose one: extremely low, very low, low, average, high, very high, extremely high)
PART 3—YOUR PERCEPTIONS ABOUT BIM AFTER ATTENDING UNIVERSITY COURSE BYG230
Q3.1 How would you rate your awareness of BIM? (choose one: extremely low, very low, low, average, high, very high, extremely high)
Q3.2 How would you rate your interest in BIM? (choose one: extremely low, very low, low, average, high, very high, extremely high)
Q3.3 How would you agree with this sentence: knowledge about BIM can provide better job opportunities? (choose one: extremely low, very low, low, average, high, very high, extremely high)
Q3.4 How would you rate your expectations about the university course BYG230? (choose one: extremely low, very low, low, average, high, very high, extremely high)
PART 4—ABOUT THE CONTENT OF UNIVERSITY COURSE BYG230
Q4.1 Which software did you find most interesting? (choose one: Revit, Dynamo, ISY Calcus, ISY Beskrivelse, Solibri)
Q4.2 Which software did you find least interesting? (choose one: Revit, Dynamo, ISY Calcus, ISY Beskrivelse, Solibri)
Q4.3 Do you think that working with BIM software is easy? (choose one: extremely low, very low, low, average, high, very high, extremely high)
Q4.4 Do you think that working with BIM software can enhance your creativity? (choose one: extremely low, very low, low, average, high, very high, extremely high)
Q4.5 Do you desire to continue learning BIM in the future? (choose one: extremely low, very low, low, average, high, very high, extremely high)
Q4.6 Do you think that BIM needs to be taught at university? (choose one: extremely low, very low, low, average, high, very high, extremely high)
PART 5—ABOUT THE TEACHING OF UNIVERSITY COURSE BYG230
Q5.1 Do you think that the teachers promoted critical thinking about BIM concepts? (choose one: extremely low, very low, low, average, high, very high, extremely high)
Q5.2 Do you think that the topics lectured were fully understandable? (choose one: extremely low, very low, low, average, high, very high, extremely high)
Q5.3 What is your overall rating of the course? (choose one: extremely low, very low, low, average, high, very high, extremely high)

Figure 1, representing the data collected by survey Part 1 (columns A, B, C, D in "Survey dataset.xlsx"), illustrates the geographical origin of the 28 students: their largest part comes from Rogaland, which is also the county where University of Stavanger (UiS) is located. The mean and standard deviation of age is 26.5 ± 5.4. Male is the predominant gender and the most common study direction of the students is construction engineering (61%), followed by urban planning (32%) and technical planning (7%). Figure 2 shows the respondents' perceptions before and after attending the university course BYG230, namely during the first week of September 2022 and during the last week of November 2022, respectively, collected by Part 2 (columns E, F, G, H in "Survey dataset.xlsx") and Part 3 (columns I, J, K, L in "Survey dataset.xlsx"). Figure 3 portrays the percentage of the illustrated software and digital tools that the students liked the most and the least, as investigated in Part 4 (columns M, N in "Survey dataset.xlsx") of the survey. Finally, Figures 4 and 5 display the collected data when it comes to satisfaction extent about the academic course as probed by Part 4 (columns O, P, Q, R in "Survey dataset.xlsx") and the way it was conducted as probed by Part 5 (columns S, T, U in "Survey dataset.xlsx"), respectively. The data displayed in Figures 2, 4 and 5 show the students' perceptions according to a 7-point Likert scale varying from "1 = extremely low" to "7 = extremely high".

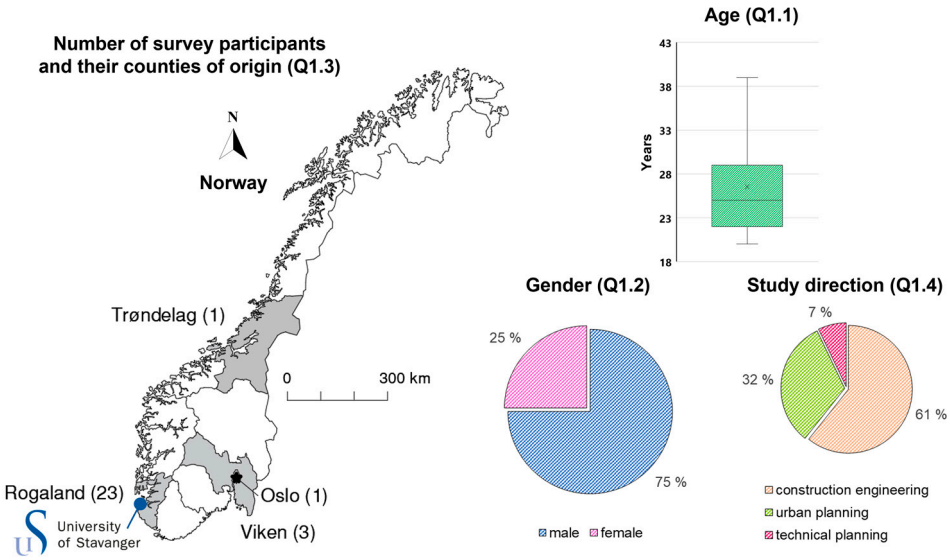

Figure 1. Socio-demographic data of the 28 civil engineering students who attended the academic course about BIM at University of Stavanger (UiS), Norway (survey Part 1).

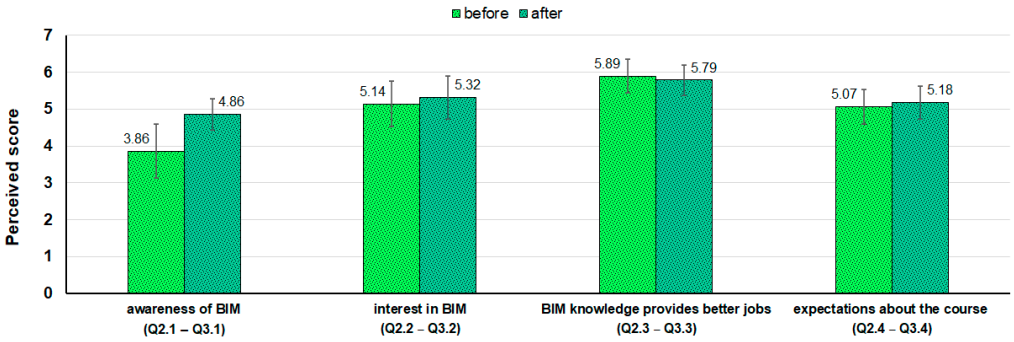

Figure 2. Average score of students' perceptions about some BIM aspects before and after attending the academic course (survey Part 2 and Part 3). 1 = extremely low, 2 = very low, 3 = low, 4 = average, 5 = high, 6 = very high, 7 = extremely high.

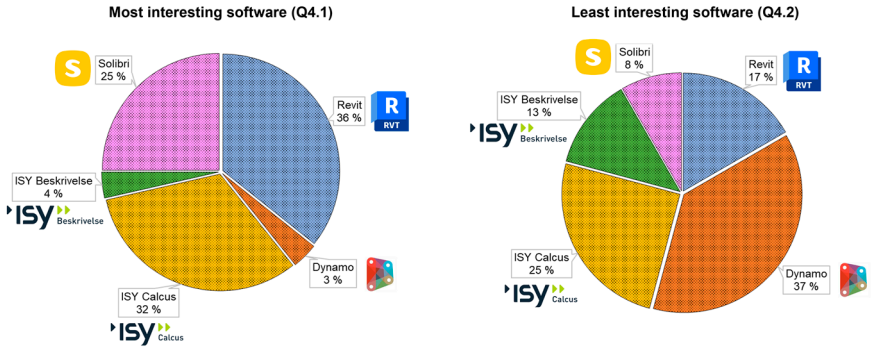

Figure 3. Most interesting and least interesting software among the ones dealt with in the academic course (survey Part 4).

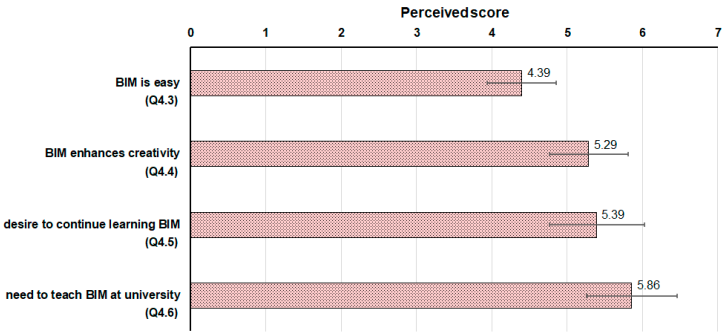

Figure 4. Average score of students' perceptions about some BIM aspects (survey Part 4). 1 = extremely low, 2 = very low, 3 = low, 4 = average, 5 = high, 6 = very high, 7 = extremely high.

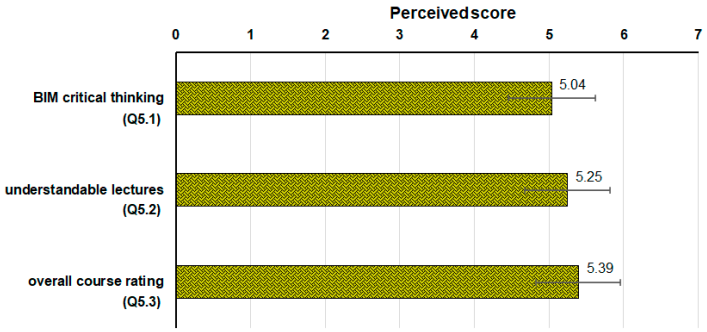

Figure 5. Average score of students' perceptions about some BIM aspects (survey Part 5). 1 = extremely low, 2 = very low, 3 = low, 4 = average, 5 = high, 6 = very high, 7 = extremely high.

Considering the trends of all the collected data displayed in Figures 2–5, it is possible to state that the students benefit from the academic course when it comes to enhancing the awareness of BIM as well as their interest in the subject. Furthermore, the use of software Autodesk Revit and Solibri is met with great enthusiasm; on the other hand, the students are much less eager to work with Autodesk Dynamo. Very different opinions exist regarding ISY Calcus: a considerable number of students enjoy the use of this software while, at the same time, another large group of students do not offer positive feedback in this regard. This trend can be useful to tailor the future course content, e.g., choose which software should be illustrated, how to make the application of some digital tools more attractive, employ alternative resources produced by other software houses. Broadly speaking, the course does stimulate the curiosity and critical thinking of the undergraduates, who confirm their desire and necessity to learn BIM at university.

Table 2 illustrates the Cronbach's alpha for the items listed in four different parts of the questionnaire, the values indicate the reliability of the dataset. The distributions of

the responses pertaining to questions Q2.1, Q2.2., Q2.3, Q2.4, Q3.1, Q3.2., Q3.3, Q3.4, Q4.3, Q4.4, Q4.5, Q4.6, Q5.1, Q5.2., Q5.3 are not normal and not symmetric. It is important to stress a possible limitation of the collected data. Considering the very moderate sample size (28 students), users of the dataset should be careful when trying to infer major trends or draw generalized conclusions. Rather, the dataset can provide a useful insight into a new academic course encompassing a technological area which is in high demand, both in Norway and abroad, as well as shed light on the feedbacks and perceptions expressed by university students dealing with BIM for their first time.

Table 2. Values of Cronbach's alpha (internal consistency) for the responses related to Part 2, Part 3, Part 4 and Part 5.

	Part 2	Part 3	Part 4	Part 5
Number of items	4	4	4	3
Cronbach's alpha	0.751	0.818	0.812	0.854

3. Methods

Building Information Modelling (BIM) is a digital semantic representation of physical and functional features of real objects [2], its application to the design and maintenance of civil structures and infrastructures has been gaining huge momentum in the last decade [3–5]. Considering the urgency of bridging industry needs and institutional education, the pedagogical approach about BIM has begun to coalesce in several university programs across the globe pivoting on three main areas: (i) continuous learning, (ii) hands-on experience and (iii) integration of real project examples [6–8]. Moreover, teaching BIM can effectively bolster students' abilities that are highly valued in the industry, e.g., teamwork, soft skills, interdisciplinary perspectives [9–11]. On a global perspective, Norway, together with the other Nordic countries, represents a leader in the implementation of BIM technologies in both private and public industry sectors [12–15]. Therefore, the Norwegian centres of higher education play a vital when it comes to BIM education [16–18].

Based on these premises, there are more and more studies focusing on the quality of BIM education and the need to raise an awareness and foster interest among the students [19]. The array of questions included in the administered survey has been created after a careful examination of recent academic peer-reviewed works as reported in Table 3: the questionnaires contained in these investigations focus on students' viewpoint in education settings when it comes to the much-needed implementation of paradigm shift in BIM learning and teaching [20–29].

Table 3. Overview of the main recent survey investigations regarding the perceptions of civil engineering students about Building Information Modelling (BIM).

Author	Year	Country	Sample Size	Socio-Demographics	Perceptions about BIM	Perceptions about Course Content	Perceptions about the Teaching
[28]	2014	USA	120		X	X	X
[27]	2016	Australia	65		X		
[21]	2016	Korea	69	X	X	X	
[26]	2019	Australia	257	X	X		
[29]	2019	USA	106	X	X	X	X
[24]	2020	Brazil	45		X	X	
[25]	2020	Turkey	32	X	X	X	
[23]	2022	Bangladesh	20		X	X	X
[22]	2022	China	1090	X	X		
[20]	2023 [1]	Cambodia	217	X	X	X	
This work	2023	Norway	28	X	X	X	X

[1] Available online 9 June 2022.

The survey dataset was distributed using the Norwegian online platform "Nettskjema". The questionnaire (single cross-sectional survey) was created in Norwegian using a purposive sampling technique [30–32]: all the 28 civil engineering students attending the academic course about BIM "Construction Management—BYG230" ("Byggadministrasjon med BIM—BYG230" in Norwegian) at University of Stavanger, Norway, between September 2022 and November 2022 received the link to the survey. The dataset for Part 2 was generated during the first week of September 2022, namely before the start of the course. The dataset for all the other parts (Part 1, Part 3, Part 4, Part 5) were generated at the end of the course, namely during the last week of November 2022. Therefore, when it comes to Part 2 and Part 3, it is possible to effectively compare the students' viewpoint on BIM "before" and "after" attending the course.

As no cases of obviously unrealistic responses have been registered, all the 28 responses are considered valid. The survey was designed to be flexible enough for rapid deployment, as just a few minutes are necessary to fill the questionnaire. Considering the main limitations of this work (i.e., moderate sample size, specific context of the University of Stavanger), future similar research efforts could, for instance, follow two paths: (i) involve more universities in Norway or in the Nordics to attain a comprehensive understanding of students' viewpoint in those countries currently on the forefront of BIM implementation, (ii) encompass more universities in other countries where BIM application is currently gaining momentum and need inclusion in the study curricula.

4. User Notes

- In light of the global surging necessity to understand, develop and apply Building Information Modelling (BIM) technology solutions in civil engineering and considering the central role played by the higher education sector, this dataset conveys perceptions and opinions expressed by undergraduate students attending an academic course specifically dealing with BIM.
- Considering the worldwide relevance of BIM implementation for civil structures and infrastructures as well as the importance of academic education, the dataset can offer precious inspiration for a wide array of private industries as well as public agencies and can become particularly relevant for all the individuals engaged in BIM education, such as researchers and teaching staff.
- The data can be used to quantify the perceptions, opinions and viewpoints of students going through BIM education. A statistical analysis software can also be used to analyse the dataset. Any obtained results can inspire private industries and teaching staff involved in higher education when it comes to delivering more efficient BIM technology solutions as well as improving the course content.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the survey.

Data Availability Statement: Dataset is uploaded on Mendeley Data. Repository name: Perceptions of civil engineering students about Building Information Modelling (BIM) https://data.mendeley.com/datasets/sb8yhb3ppw accessed on 6 May 2023.

Conflicts of Interest: The authors declare no conflict of interest.

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