Surveying constructive alignment using CALEQ – exploratory factor analysis

C.B. Strømme[1], H. Barron[2], and J. Nyléhn[1],
[1]*University of Bergen, Department of biological sciences/bioCEED,*
[2]*Bemidji State University, Department of Biology*

ABSTRACT: Constructive alignment has influenced outcomes-based higher education worldwide as a tool for course design. Framed on this principle, the Constructive alignment learning experience questionnaire (CALEQ) was developed by Australian education researchers for the purpose of surveying student perceptions of key course aspects. Here we present a first step in the validation process of a CALEQ version available in Norwegian Bokmål that was developed at UiB in 2021. We performed an exploratory factor analysis using data obtained from student responses to the twenty items of CALEQ to identify the underlying factor structure. Our analysis indicates a three-factor structure for the four main constructs of CALEQ, suggesting a strong association between how students respond to items concerning clarity of intended learning outcomes and teaching alignment. As a next step, we will assess these results in correspondence with available qualitative data from associated focus group interviews with students.

1 INTRODUCTION

The Constructive Alignment Learning Evaluation Questionnaire (CALEQ) was developed for surveying student perceptions of their learning situations in university courses (Fitzallen et al. 2017), framed on the principle Constructive alignment (Biggs 1996). The survey is structured onto four different scales intended to capture student perceptions of the relationships between learning outcomes (ILOs), teaching and learning (T&L) activities, assessment and feedback received from instructors. Despite the impact of constructive alignment in higher education, there is scarce evidence of CALEQ being applied in higher education research literature (but see Roßnagel et al. 2021).

We tested a Norwegian language (Bokmål) version of CALEQ in student surveys for undergraduate biology courses at the University of Bergen (UiB) to assess the applicability of CALEQ in a Scandinavian context. This report details the initial step for validating CALEQ in Norwegian where we applied exploratory factor analysis.

2 THEORETICAL BACKGROUND

Constructive alignment was initially put forward by John Biggs (1996) as a student-centred approach to higher education course design. The principle is founded on constructivism, thereby implying that the learner gradually develops knowledge based on previous knowledge and through experience and interaction with the surrounding environment. In its essence, constructive alignment is concerned with the inherent dynamics between the intended learning outcomes (ILOs), the teaching and learning activities and assessment activities in a course (Biggs & Tang 2011). This interdependence is often visualized as a triangle (Figure 1). Constructive alignment started out as a theoretical construct, framed in discussions of educational quality among teachers, administration, and educational developers. Meanwhile, Loughlin et al. (2021) warn that the concept of constructive alignment can be applied top-down in a mechanistic and simplistic manner as a quality assurance tool, which might undermine and diminish its relevance for educational development.

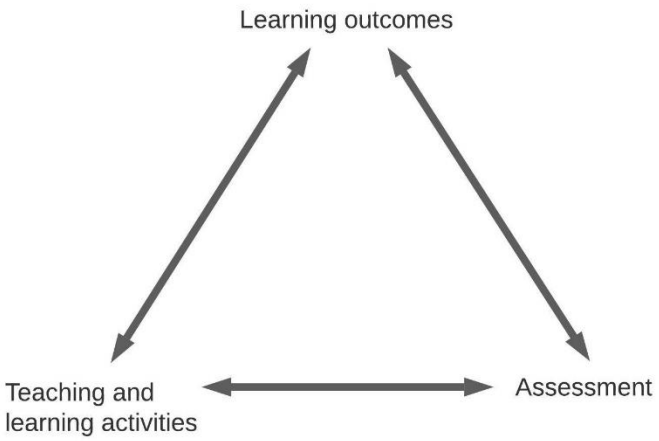

Figure 1. Constructive alignment illustrated as a triangle with interdependence among the intended learning outcomes, teaching and learning activities and the assessment. Adapted from Biggs (1996).

3 METHODS

3.1 Translation of questionnaire

The questionnaire (Table 1) was translated from English to Norwegian in a stepwise process: 1) individual translations by CBS, JN (authors) and Arild Raaheim (Professor in Pedagogy, UiB); 2) consensus translation by the three translators; 3) evaluation and feedback on the translated survey by a group of student collaborators, and 4) testing of the translated survey as part of a Master Thesis project.

3.2 Surveys

The CALEQ survey items were included in electronic student course evaluation questionnaires used for six undergraduate courses taught between 2021 and 2022 at the Department of biological sciences (BIO), University of Bergen (UiB). The questionnaires were uploaded and distributed using SurveyXact (Ramboll, Denmark), and this service provider collected the survey responses. At the beginning of the questionnaire, students were informed of the research purpose of the questionnaire and asked for consent. Responses from students that declined were omitted from the study. The sequence of the twenty items was randomised in each questionnaire and responses were on a five-point Likert scale (“Strongly disagree”, “Disagree”, “Neutral”, “Agree”, “Strongly agree”). A sixth option was included if the students perceived the item not to be relevant to the course experience (“Not applicable”). In those cases, responses were omitted. Out of 310 survey respondents that consented to data being used for research purposes, 145 had complete answers for all 20 items in CALEQ and could thus be used for exploratory factor analysis.

3.3 Statistical analysis

We performed exploratory factor analysis in R (R Core Team 2021) using functions in the package *psych* (Revelle 2021). We performed a Kaiser-Meyer-Olkin (KMO) test (function *KMO*) to assess whether the data could be subjected to exploratory factor analysis. We extracted factors using Velicer’s minimum average partial (MAP) test (function *vss*) and used the function *fa* for the factorial analysis. For factor extraction and analysis, we specified the correlation type to polychoric since the Likert response categories were on an ordinal scale. Further, we applied oblimin rotation and maximum likelihood estimation. We represented the outcome using a factor diagram produced by applying the function *fa.diagram*.

Table 1. Constructive alignment learning experience questionnaire items in Norwegian (translated) and English (Fitzallen et al. 2017) versions.

Label	Norwegian (Bokmål)	English
ClarityILO1	Jeg hadde en klar forståelse av hva jeg skulle lære	I had a clear idea of what I was supposed to learn
ClarityILO2	Jeg fikk en klar forståelse av hvordan det jeg lærte kunne anvendes	I was given a clear idea of what I needed to be able to do with the topics learnt
ClarityILO3	Jeg var aldri i tvil om hva jeg skulle lære underveis i dette emnet	I was never in doubt about what I was supposed to be learning in this unit
ClarityILO4	Emneplanene var klare med hensyn til hva jeg skulle lære	The unit documents clearly outlined what I was supposed to learn
ClarityILO5	Jeg ble jevnlig minnet på hva jeg skulle lære i emnet	I was constantly reminded of what I was supposed to learn during the unit
TeachAlign1	Undervisnings- og læringsaktivitetene var rettet mot det jeg skulle lære	The teaching and learning activities addressed what I was supposed to learn
TeachAlign2	Undervisnings- og læringsaktivitetene bidro til at jeg lærte det jeg skulle	The teaching and learning activities helped me learn what I was supposed to learn
TeachAlign3	Undervisningen la opp til aktiv deltakelse i det jeg skulle lære	I was provided the opportunities to actively participate in what I was supposed to learn
TeachAlign4	Emnet inneholdt varierte aktiviteter som bidro til at jeg lærte det jeg skulle	I was provided a variety of activities that helped me learn what I was supposed to learn
TeachAlign5	Jeg fikk klar informasjon om hva jeg trengte å gjøre for å lære det jeg skulle	I was given clear and specific instructions as to what to do in learning what I was supposed to learn
Assessment1	Eksamen/vurderingsformen hadde klar sammenheng med det jeg skulle lære	The assessment tasks addressed what I was supposed to learn
Assessment2	Jeg fikk klar informasjon om hvordan eksamen/vurderingsformen samsvarte med det jeg skulle lære	It was explained clearly to me how the assessment tasks were related to what I was supposed to learn
Assessment3	Eksamen/vurderingsformen ga meg anledning til å vise hvor godt jeg hadde lært det jeg skulle	The assessment tasks provided opportunities for me to demonstrate how well I had achieved what I was supposed to learn
Assessment4	Karakteren(e) min(e) samsvarte relativt bra med hvor godt jeg hadde oppnådd det jeg skulle lære	The grades that I received indicated fairly how well I had achieved what I was supposed to learn
Assessment5	Jeg fikk nyttig tilbakemelding på hvor bra jeg hadde oppnådd det jeg skulle lære	I received useful feedback on how well I had achieved what I was supposed to learn
Feedback1	Jeg fikk tilbakemelding som samsvarte med oppgitte vurderingskriterier	I received feedback that related directly to the assessment criteria
Feedback2	Jeg fikk klar tilbakemelding på hva jeg skulle lære	I received feedback that was clear and specific to what I was supposed to learn
Feedback3	Jeg fikk tilbakemelding som bidro til at jeg kunne forberede meg til neste vurdering	I received feedback that helped me prepare for the next assessment tasks
Feedback4	Tilbakemeldingene ga meg en mulighet til å ta grep for å forbedre egen læring	I could take action to improve my own learning based on the feedback provided
Feedback5	Tilbakemeldingene gjorde meg bedre i stand til å vurdere eget arbeid	I was able to make informed judgements about my own work from the feedback provided

4 RESULTS AND DISCUSSION

In terms of overall factor score adequacy, the KMO test yielded an overall measure of 0.91, with item measures ranging from 0.66 (item Assessment 4, "The grades that I received indicated fairly how well I had achieved what I was supposed to learn") to 0.96 (item Feedback 2, "I received feedback that was clear and specific to what I was supposed to learn").

For factor extraction, we obtained a minimum MAP estimate of 0.03 with three factors that together explained 64% of total variance (Fig. 2). Items from the scales Clarity of ILOs and Teaching Alignment grouped onto factor 1 that accounted for 28% of total variance. Further, items from the Feedback effectiveness grouped together with Assessment Alignment item 5 onto factor 3 that accounted for 14% of total variance. The remaining four items from the Assessment Alignment scale grouped onto factor 2 that accounted for 23% of total variance.

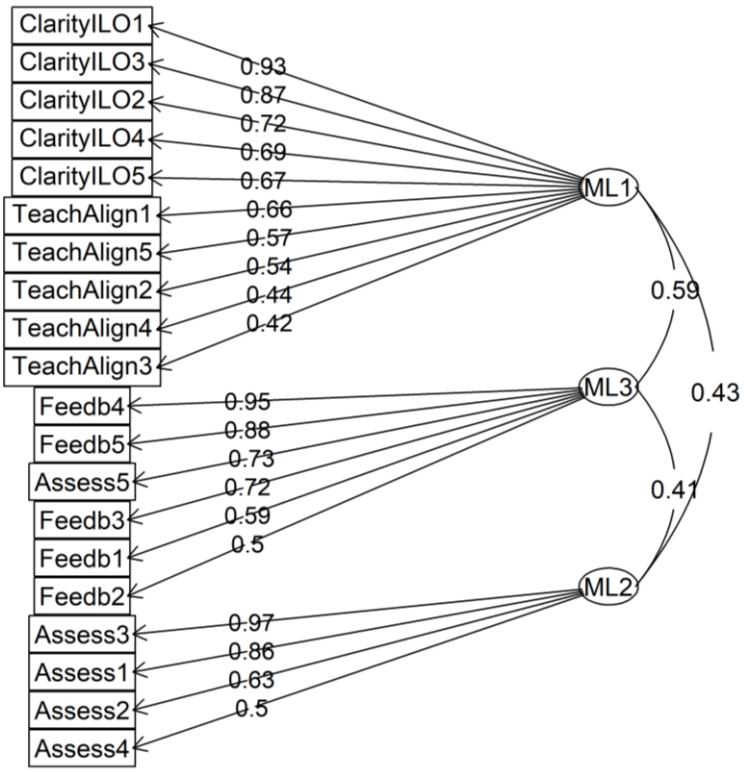

Fig. 1. Three-factor structure for Constructive Alignment Learning Experience Questionnaire items using maximum likelihood estimation. Factor loadings are displayed on straight vertices to the left while factor correlations are shown on curved vertices to the right. Data were obtained from 145 complete responses to course evaluation questionnaires obtained between 2021 and 2022.

We were able to perform an exploratory factor analysis of the twenty items in a Norwegian version of CALEQ using data obtained from 145 students in undergraduate biology courses. While CALEQ is structured as four separate scales directed at the main aspects of constructive alignment, the analysis of our data revealed three factors that together explained 64% of total variance. Although the items addressing *Feedback effectiveness* and *Assessment alignment* grouped mainly along the lines of those scales, Clarity of ILOs and Teaching alignment items were all grouped onto a single factor.

The grouping of *Clarity of ILOs* and *Teaching alignment* items suggests a strong association between these scales in our data. Although the survey responses were obtained from six different undergraduate courses over a period of two years, we cannot exclude that this association results from local influences such as teaching culture. Therefore, we suggest that additional data from other departments and higher education institutions in Norway can help clarify whether the association between those two scales can be attributed to the respective constructs or rather the context in which our data were gathered.

For the factors ML2 and ML3, items grouped along the lines of the respective CALEQ scales except for one occurrence. While the item Assessment5 ("I received useful feedback on how well I had achieved what I was supposed to learn") was formulated by the creators of CALEQ under the construct *Assessment alignment*, our analysis grouped this item onto factor ML3 with the items from *Feedback effectiveness*. We suggest that this result can be related to the wording of the item, since the object of the sentence is "useful feedback".

Constructive alignment was developed by John Biggs (1996) primarily as a student-centred approach to teaching and learning. The principle has been shown to promote academic achievement of students and has since its origin grown in popularity among educators and educational developers. The CALEQ questionnaire is, to our knowledge, the first attempt to numerically assess students' perceptions of how well learning objectives are aligned with teaching and assessment. In relation to our work with CALEQ at our institution, the questionnaire has been included in student surveys intended for course evaluation. As a next step, we will assess how available qualitative data from focus group interviews with students can inform the factor structure that was revealed in our exploratory analysis. Further, expanding the data series to include respondents from other institutions and disciplines can help clarify the suitability of CALEQ to assessing constructive alignment for courses in Norwegian higher education.

4.1 Limitations of the study

This is a pilot study using CALEQ that has involved a limited number of courses at BIO, UIB. To our knowledge, this is the first translation and application of CALEQ in a Norwegian context.

5 ACKNOWLEDGMENTS

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