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Exploring the Factor Structure and External Correlates of Design Attitude

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ABSTRACT

Design Attitude offers a way to conceptualize how individuals engage with uncertainty and generate possibilities in creative practice. However, the relationship between theoretically differentiated characteristics of Design Attitude and its empirically observed dimensional structure remains unclear. This study examined the factor structure of 36 theoretically derived Design Attitude items and their associations with creative self-efficacy (CSE), general self-efficacy (GSE), and a study-specific indicator of PERMA-related well-being. An online survey yielded 828 analyzable responses, randomly split into an exploratory sample (n = 414) and an evaluation sample (n = 414). Exploratory factor analysis yielded an interpretable five-factor solution comprising 34 items. A subsequently refined confirmatory factor analysis model comprised 33 items (CFI = .918, TLI = .910, RMSEA = .059, SRMR = .058). Scores for the five dimensions were positively correlated with CSE, GSE, and PERMA-related well-being. In hierarchical regression, adding the five Design Attitude dimensions after demographic and design-related characteristics, sleep indicators, and GSE increased R^2 for the PERMA-related indicator by .170. Overall, the findings indicate that the nine theoretically differentiated characteristics were not reproduced one-to-one in questionnaire responses but were reorganized into five broader, correlated dimensions. Because the CFA model was refined within the evaluation sample and the well-being measure was study-specific, the resulting structure should be regarded as a provisional measurement model requiring further validation rather than as a finalized Design Attitude scale.

Keywords: Design attitude, Measurement, Factor structure, Self-efficacy, Well-being

INTRODUCTION

Design Attitude has been discussed as an orientation toward exploring new possibilities and shaping situations under uncertainty, rather than merely selecting solutions from predefined alternatives (Boland & Collopy, 2004). Related design scholarship has emphasized designerly ways of knowing, the co-evolution of problems and solutions, and reframing under uncertainty as characteristic features of design practice (Cross, 2001; Dorst & Cross, 2001; Dorst, 2011). These accounts provide a theoretical basis for understanding design as an orientation toward envisioning possibilities, interpreting emerging situations, and generating meaning. If Design Attitude is to be examined as an individual orientation beyond the professional category of designer, however, an important measurement question arises: whether characteristics that are theoretically distinguishable in descriptions of design

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practice also emerge as distinguishable psychological dimensions when assessed through questionnaire responses.

Previous research has conceptualized design-related orientations using related but non-identical frameworks. Michlewski (2008) identified five theoretical categories Design Attitude from interviews with professional designers and managers. Blizzard et al. (2015) mapped nine survey items onto five related characteristics of design-thinking in U.S. college students, while Vignoli et al. (2023) developed a 31-item, ten-dimensional Design Thinking Mindset scale. Together, these studies show that design-related orientations can be assessed as individual differences, but that dimensional organization depends on the underlying framework and item pool.

Research specifically addressing Design Attitude has also used multidimensional measures. The 15-item Design Attitude Measure (DAM) used by Nagamori et al. (2026) comprises Experimentalism, Optimism, Visualization, Collaboration, and Empathy. Although these dimensions overlap with the broader literature, the DAM operationalizes Design Attitude differently from the nine-characteristic framework examined here; its findings therefore cannot determine how the present item pool is organized.

The present research begins from a working theoretical framework comprising nine candidate characteristics—Deep Insight, Ambiguity Acceptance, Optimism, Creativity, Aesthetic Sensitivity, Experiential Intelligence, Modeling and Navigation, Empathy, and Visualization—which were derived through a synthesis of prior literature on Design Attitude and related design-oriented characteristics in the author's previous research (Isobe, 2025). These characteristics provided the conceptual domains from which the present item pool was developed. The purpose of the present study is therefore not to replace existing Design Attitude or Design Thinking measures, but to examine how these nine theoretically differentiated characteristics are organized when translated into questionnaire responses. This distinction is central to the present research: characteristics that are useful for describing design-oriented practice at the conceptual level may be combined or reorganized when examined as empirical dimensions of individual differences.

Our earlier studies examined within-activity psychological and physiological dynamics during creative activity (Isobe & Edagawa, 2025, 2026), whereas the present study examines between-person differences in design-related orientations. Nagamori et al. (2026) likewise used the DAM Visualization subscale in a naturalistic design task, but that application addresses a different question from the present examination of a theoretically derived item pool.

A further issue concerns the conceptual boundaries between Design Attitude and related psychological constructs. Creative self-efficacy (CSE) refers to confidence in one's ability to produce creative outcomes (Tierney & Farmer, 2002), whereas general self-efficacy (GSE) concerns broader beliefs about one's capacity to cope with challenges. Design Attitude is theorized more broadly in the present study as involving orientations toward ambiguity, possibility generation, interpretation, representation, aesthetic engagement, experiential learning, and interpersonal understanding.

Positive associations between Design Attitude, CSE, and GSE are therefore theoretically plausible. At the same time, strong associations would raise an important construct-boundary question: whether some dimensions derived from the Design Attitude item pool provide information that is meaningfully distinguishable from existing efficacy-related self-beliefs. Examining these associations can therefore provide initial evidence regarding the location of the emerging Design Attitude dimensions within a broader network of related psychological self-reports, while also identifying areas in which conceptual overlap requires further investigation.

Well-being provides an additional external point of comparison. This question differs from that addressed by Positive Design, which concerns how products and services can be designed to support the well-being of users and beneficiaries (Desmet & Pohlmeyer, 2013). The present study instead asks whether individuals who report stronger design-related orientations also tend to report higher levels of well-being. The PERMA framework provides five conceptual domains of positive functioning—positive emotion, engagement, relationships, meaning, and accomplishment (Seligman, 2011). However, well-being is treated here as an external correlate rather than as an outcome presumed to result from Design Attitude. Moreover, because the present survey used one study-specific item for each PERMA domain rather than the validated PERMA-Profiler (Butler & Kern, 2016), the resulting composite is treated throughout as a PERMA-related well-being indicator rather than as a validated multidimensional PERMA measure.

Accordingly, the present study examines 36 items developed from nine theoretically proposed Design Attitude characteristics. It addresses two research questions. RQ1 asks how these items are organized in exploratory factor analysis and how the resulting structure is evaluated and subsequently refined in CFA using a separate respondent group. RQ2 asks how the extracted dimensions are associated with CSE, GSE, and a study-specific PERMA-related well-being indicator.

The aim is to provide initial evidence regarding how a working theoretical framework of Design Attitude is reflected in an empirical questionnaire structure and how the resulting dimensions are positioned in relation to theoretically relevant psychological indicators. The extracted factors are therefore regarded as provisional empirical dimensions rather than as established subscales of a finalized instrument. Similarly, their associations with CSE, GSE, and PERMA-related well-being are interpreted as external correlates rather than evidence of causal effects or temporal mechanisms. How Design Attitude is enacted, changes, and persists during creative practice remains a separate question requiring process-oriented, longitudinal, or repeated-measures research.

THEORETICAL FRAMEWORK

The item pool was organized around nine candidate characteristics—Deep Insight, Ambiguity Acceptance, Optimism, Creativity, Aesthetic Sensitivity, Experiential Intelligence, Modeling and Navigation, Empathy, and Visualization—originally derived as a conceptual framework through

a synthesis of prior literature in previous research (Isobe, 2025). These characteristics functioned as theoretical content domains for item generation; they were not specified a priori as nine latent factors. The central measurement question was therefore how distinctions made at the conceptual level would be organized in patterns of questionnaire responses.

The nine characteristics were selected to provide broad conceptual coverage of design-related orientation. Deep Insight and Ambiguity Acceptance concern how individuals attend to, interpret, and remain engaged with uncertain or incompletely defined situations. Optimism and Creativity concern possibility-oriented exploration and the generation of alternatives. Aesthetic Sensitivity and Visualization concern perceptual, aesthetic, and representational engagement. Experiential Intelligence, Modeling and Navigation, and Empathy concern learning through action and experience, structuring and navigating possibilities, and attending to the perspectives and experiences of other people. These descriptions define the theoretical domains used in item generation rather than prespecified psychometric subscales.

A correlated-factor perspective is appropriate to this framework because these orientations are not assumed to operate independently. An individual may simultaneously display several design-related tendencies, and theoretical distinctions among the nine characteristics need not correspond to statistically independent dimensions. Accordingly, factor analysis is used to examine how these theoretically differentiated domains are organized in response patterns rather than to reproduce the working framework one-to-one.

The distinction between Design Attitude and confidence in one's capacity to create is particularly important. For example, an individual may report confidence in generating creative ideas while being less comfortable with ambiguity, or may show a strong orientation toward reframing and visualization while reporting more limited confidence in creative performance. Associations with CSE and GSE can therefore provide initial information about the nomological position of the emerging Design Attitude dimensions. Conversely, very strong associations would indicate that their conceptual boundaries require further examination. The well-being analysis is similarly exploratory: the PERMA framework provides a theoretically relevant description of positive functioning, while the five-item measure used in the present study provides only a study-specific indicator of those domains.

METHOD

Participants and Procedure

In August 2026, a cross-sectional questionnaire survey was administered through Freeasy, a Japanese online survey platform. The study was approved by the Research Ethics Committee of Ritsumeikan University (Approval No. ERHSS-2025-127). Of 984 responses, 156 were excluded following response-quality screening, leaving 828 valid responses. Respondents were randomly divided into Group A (n = 414) for EFA and Group B (n = 414) for CFA. Standardized mean differences between Groups A and B for continuous variables were small (–.028 to .060).

The two-group allocation served different analytical purposes: Group A was used to explore item clustering and make item-retention decisions, whereas Group B was reserved for evaluating the resulting configuration. Because both groups originated from one online survey, the split reduces direct reuse of respondents across the two stages but does not establish transportability to a new population. No longitudinal, experimental, or behavioral outcome was collected for the analyses reported here.

Measures

The initial Exploratory Design Attitude Scale (EDAS) item pool comprised 36 items, four for each of nine candidate characteristics, rated on a five-point scale. These characteristics served as content domains for item generation rather than as predetermined factors. The present study evaluates the empirical organization of this existing item pool; it does not constitute a complete content-validation study of the item-generation process. CSE was assessed using four items intended to represent creative self-efficacy, with Tierney and Farmer (2002) serving as the conceptual reference for the construct. GSE was assessed using two items drawn from Sakano and Tohjoh (1986); accordingly, this score represents a brief GSE indicator rather than the complete original scale. PERMA-related well-being was assessed using five Japanese-language items developed for this study, one each for positive emotion, engagement, relationships, meaning, and accomplishment. Responses were recorded on a five-point scale, and the mean of the five items was used as the analytical indicator. The conceptual framework was based on Seligman (2011), but the item-by-item adoption or adaptation history relative to the original PERMA-Profiler (Butler & Kern, 2016) could not be confirmed. Accordingly, the indicator is not presented as the original instrument or as a validated short form. Sleep-related covariates comprised subjective sleep quality, difficulty falling asleep, daytime sleepiness, and categorized sleep duration.

Analytical Strategy

In Group A, EFA was conducted using principal axis factoring with Promax rotation on a Pearson correlation matrix, treating five-point responses as approximately continuous. Factor-retention decisions considered parallel analysis, Velicer's MAP, eigenvalues, scree-plot inspection, loading patterns, theoretical coverage, and interpretability. Items were reviewed for weak primary loadings and cross-loadings. In Group B, the emergent factor configuration was evaluated using χ^2/df, CFI, TLI, RMSEA, and SRMR. Because the model was subsequently refined within Group B, the final CFA specification was not independently cross-validated.

Bivariate correlations and hierarchical multiple regression were used to examine external associations in Group B (n = 414), with PERMA-related well-being as the dependent variable. Predictor blocks were entered in the following order: demographic/design-related characteristics, sleep variables, GSE, the five EDAS dimension scores, and CSE. Changes in explained variance are therefore conditional on this entry order and do not establish a

unique causal contribution of Design Attitude or incremental validity beyond variables entered subsequently. Dimension scores were treated as observed composites in the external-association analyses.

RESULTS

Exploratory Factor Structure

Parallel analysis and MAP provided some support for a six-factor solution, although the MAP values for five and six factors were nearly identical. Thus, the factor-retention criteria did not point unequivocally to a single solution. Considering the available loading patterns, theoretical coverage, and interpretability together, the five-factor solution was retained as the more substantively coherent representation for the present study. CR2 and CR3 were removed because of problematic cross-loadings: CR2 showed a substantial secondary loading (≥ .30) on a non-target factor, whereas CR3 showed high cross-loadings across multiple factors with limited separation from its primary loading. The EFA was then repeated with the remaining 34 items, yielding five correlated dimensions: Creative Optimism and Openness (COO), Visual Modeling and Navigation (VMN), Deep Insight and Acceptance (DIA), Empathic Intelligence (EMI), and Aesthetic Sensitivity (AE).

The five labels summarize the observed item clusters rather than reproducing the original nine-characteristic taxonomy. In particular, Creative Optimism and Openness and Visual Modeling and Navigation describe relatively broad orientations, while Deep Insight and Acceptance, Empathic Intelligence, and Aesthetic Sensitivity retain other aspects of the candidate framework. Correlated factors are compatible with the proposition that these orientations may operate together in practice; the factor solution alone does not establish their developmental sequence or underlying mechanism.

Confirmatory Factor Analysis

In Group B, the five-factor configuration identified in Group A was evaluated and subsequently refined. EI4 was excluded because it showed substantial cross-loading and a relatively weak primary loading on Empathic Intelligence; its removal improved model fit without altering the overall five-factor configuration. This resulted in a 33-item model. Five residual covariances (e2–e3, e1–e2, e18–e20, e19–e20, and e6–e25) were then freely estimated. The revised model showed $\chi^2(480) = 1168.279$, $\chi^2/df = 2.434$, CFI = .918, TLI = .910, RMSEA = .059 (90% CI [.055, .063]), and SRMR = .058 (Table 1). The latent correlation between COO and VMN was .897, indicating substantial overlap and leaving their discriminant separation unresolved in the present study.

Because EI4 was excluded and the residual covariances were freed after inspection of the Group B data, the reported fit indices describe an exploratorily refined model rather than an independently confirmed final specification. In addition, the available analysis records do not establish

the correspondence between error-variable labels and questionnaire items, preventing item-content-based justification of the five residual covariances.

Table 1: Fit of the revised CFA model (Group B, n = 414).

Index	Result
χ^2 (df)	1168.279 (480)
χ^2/df	2.434
CFI	.918
TLI	.910
RMSEA [90% CI]	.059 [.055, .063]
SRMR	.058

External Associations

In Group B, the five dimension scores correlated positively with CSE (r = .472–.811), GSE (r = .464–.773), and the PERMA-related indicator (r = .533–.770). The COO–VMN dimension-score correlation was .799, and CSE correlated .700 with the PERMA-related indicator. These findings indicate substantial empirical relatedness among several of the self-report constructs, but do not by themselves establish construct equivalence or discriminant validity.

The patterns differed across dimensions. VMN showed the largest correlation with CSE (.811), whereas COO showed the largest correlation with the PERMA-related indicator (.770). These differences are descriptive and were not tested as statistically distinct effects. The high COO–VMN association, together with the strong association between VMN and CSE, identifies construct separation as an important issue for subsequent validation.

Table 2: Selected correlations (Group B, n = 414).

Dimension	CSE	GSE	PERMA-Related
COO	.712	.712	.770
VMN	.811	.773	.739
DIA	.477	.464	.533
EMI	.472	.536	.641
AE	.562	.470	.660

Hierarchical Regression

In hierarchical regression, demographic/design-related covariates accounted for $R^2 = .052$ of the variance in PERMA-related well-being. Sleep variables increased R^2 to .183, and GSE increased it to .532. Adding the five Design Attitude dimensions raised R^2 to .703 ($\Delta R^2 = .170$; F-change = 45.020, df = 5, 393; $p < .001$). Adding CSE in the subsequent block yielded $R^2 = .704$ ($\Delta R^2 = .001$; $p = .180$).

The ΔR^2 of .170 should be interpreted conditional on the specified predictor-entry order: the five Design Attitude dimension scores were entered after demographic/design-related variables, sleep indicators, and GSE, but

before CSE. Accordingly, this increment does not demonstrate that Design Attitude explains variance beyond CSE, and the small subsequent increment for CSE does not indicate that CSE is unimportant. Shared variance among predictors and block order affect incremental R^2. Some sleep-duration dummy variables also had VIF values above 5 in intermediate models; multicollinearity diagnostics therefore were not uniformly low.

Table 3: Hierarchical regression predicting PERMA-related well-being (Group B, n = 414).

Block	R^2	ΔR^2	p (ΔR^2)
Demographics / design	.052	.052	.001
+ Sleep	.183	.131	< .001
+ GSE	.532	.349	< .001
+ Five DA dimensions	.703	.170	< .001
+ CSE	.704	.001	.180

DISCUSSION

The principal finding of the present study is that nine theoretically differentiated Design Attitude characteristics were not reproduced one-to-one in questionnaire responses. Instead, the item pool was organized into five broader, correlated dimensions. The nine-characteristic framework remains useful as a conceptual vocabulary, while the findings suggest that distinctions used to describe design-oriented practice may combine into broader self-report dimensions. In particular, optimism, creativity, and related openness content converged within Creative Optimism and Openness, whereas visualization and modeling/navigation content converged within Visual Modeling and Navigation.

The resulting organization shows both convergence with and divergence from previous conceptualizations of design-related orientation. Earlier work has identified recurring themes involving optimism, experimentation, visualization, empathy, collaboration, ambiguity or openness, and broader design-thinking tendencies (Blizzard et al., 2015; Michlewski, 2008; Nagamori et al., 2026; Vignoli et al., 2023). Accordingly, the present findings are best interpreted as a particular reorganization of the nine-characteristic framework within this item pool and sample. Differences among existing frameworks may partly reflect differences in their theoretical starting points, item pools, and intended applications.

The relationship to the preceding EEG studies is complementary rather than confirmatory. Those studies examined within-activity psychological and physiological changes (Isobe & Edagawa, 2025, 2026), whereas the present survey examined between-person differences in reported orientations. The five dimensions identified here should therefore not be interpreted as stages or mechanisms of the creative process. Establishing how these orientations are enacted, change, or persist during creative activity would require longitudinal, repeated-measures, observational, or physiological evidence.

The positive associations with CSE, GSE, and the study-specific PERMA-related indicator place the five dimensions within a network of theoretically related self-reports. At the same time, several associations were sufficiently large to raise construct-boundary questions. The latent correlation between COO and VMN was .897, the corresponding dimension-score correlation was .799, and VMN correlated .811 with CSE. These findings indicate empirical proximity and make clearer construct separation a priority for subsequent measurement research.

The hierarchical regression provides a complementary description of these relationships. Adding the five Design Attitude dimensions after demographic/design-related variables, sleep indicators, and GSE increased explained variance by .170 in the specified model. This increment represents additional statistical variation conditional on the chosen entry order; it is not evidence that Design Attitude explains variance beyond CSE, which was entered subsequently, nor does it establish a causal contribution to well-being. More generally, the associations with PERMA-related well-being should be interpreted as nomological associations rather than evidence that Design Attitude enhances flourishing. The study-specific PERMA-related indicator and the other self-report measures may share evaluative wording or response tendencies, and the cross-sectional design cannot establish temporal ordering.

Several limitations qualify the evidence. First, although the EFA and CFA used separate respondent groups, both groups were drawn from the same online survey population, and the final CFA model was refined within Group B through removal of EI4 and estimation of five residual covariances. Because the available records do not preserve the item-level correspondence needed to justify those residual covariances substantively, the final 33-item specification requires evaluation in an independent sample. Second, the external measures had important limitations. The PERMA-related measure comprised one study-specific item per domain and should not be assumed to inherit the validity evidence of the original PERMA-Profiler, while GSE was represented by only two items drawn from Sakano and Tohjoh (1986). Third, all focal variables were measured by self-report at a single time point, leaving open the possibility of common-method influences and precluding causal or temporal inference. Finally, the sample was drawn from a Japanese online panel, and generalizability across cultural and linguistic contexts has not been established.

Future research should therefore evaluate the prespecified five-factor configuration in a new independent sample and document item-level model specifications and any subsequent modifications transparently. Given the high association between COO and VMN, the distinctiveness of these dimensions should receive particular attention. External associations should also be reassessed using fully validated measures and, where possible, data sources other than concurrent self-report. Separately, process-oriented studies using longitudinal, observational, repeated-measures, or physiological approaches can examine how the orientations identified here are expressed and change during creative practice.

CONCLUSION

This study provides initial evidence that nine theoretically differentiated Design Attitude characteristics may be organized into five broader, correlated dimensions at the questionnaire-response level. The findings clarify how a working conceptual framework of design-related orientations may be represented in an empirical measurement structure and document systematic associations between the resulting dimensions and CSE, GSE, and a study-specific PERMA-related well-being indicator. At the same time, the strong overlap between some dimensions, refinement of the CFA model within its evaluation sample, and limitations of the external measures indicate that the five-dimensional configuration should remain provisional. The present study therefore provides a basis for further construct refinement and independent measurement testing rather than establishing a finalized Design Attitude scale or causal model.

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