

Human or Virtual? Comparing How Influencer Credibility Shapes Purchase Intention through Parasocial Relationship and Consumer-Brand Engagement in East Kalimantan, Indonesia

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This study examines whether influencer credibility is associated with purchase intention through parasocial relationship (PSR) and consumer-brand engagement (CBE), and whether the proposed sequential association differs between human and virtual influencers. A cross-sectional survey of 450 social-media users in East Kalimantan, Indonesia, was analyzed using partial least squares structural equation modeling, bootstrapped serial mediation, measurement invariance testing, multi-group analysis, and predictive assessment. Credibility was positively associated with PSR ($\beta = 0.472$), PSR with CBE ($\beta = 0.392$), and CBE with purchase intention ($\beta = 0.517$). The serial indirect association was statistically supported ($\beta = 0.096$; 95% CI [0.064, 0.131]). The credibility–PSR association was stronger for human than virtual influencers ($\beta = 0.548$ vs. 0.391; permutation $p = 0.008$), as was the serial indirect effect ($\beta = 0.116$ vs. 0.071; $p = 0.021$). By contrast, the CBE–purchase intention association did not differ significantly between groups ($p = 0.614$). These results identify a source-type difference at the influencer–consumer bonding stage rather than at the brand-engagement–intention stage. The study contributes a dual-stage relational account that distinguishes PSR directed toward an influencer from CBE directed toward the endorsed brand. For practitioners, the findings suggest that virtual-influencer strategies may benefit from credible, consistent, and transparent persona narratives that sustain relational engagement, while both influencer types should connect audience attention to the endorsed brand. The cross-sectional, non-randomized design limits causal inference.

Keywords: consumer-brand engagement; East Kalimantan; influencer credibility; parasocial relationship; virtual influencer.

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1. Introduction

Influencer marketing increasingly involves both identifiable human creators and digitally constructed virtual personas. Human influencers offer cues drawn from lived experiences and public social histories, whereas virtual influencers rely on designed identities, controlled narratives, and digitally mediated interaction. Although virtual endorsers offer creative consistency and managerial control, their artificial origin raises questions about authenticity, perceived credibility, and the strength of consumers' psychological attachments [2], [3], [8]. The relevant marketing question is therefore not only whether human or virtual influencers generate higher purchase intention, but at which stage their persuasive associations may differ.

The issue is pertinent to an expanding Indonesian digital marketplace. In East Kalimantan, the value of transactions processed through Bank Indonesia payment infrastructure reached IDR 120.26 trillion in the first quarter of 2026, an increase of 10.03% year on year, while transaction volume rose by 31.61% to 32.15 million transactions [1]. These payment indicators do not measure influencer marketing directly; rather, they establish the broader regional digital-consumption setting. In this environment, consumers

encounter commercial content on social media, form judgments about endorsers, and evaluate endorsed brands. Explaining these distinct evaluative and relational stages is important when assessing digitally constructed endorsers alongside human ones.

Previous studies link influencer credibility to parasocial relationships and purchase-related responses [4], [5], while other work associates parasocial processes with consumer-brand engagement and engagement with purchase intention [6], [7]. Comparative research also documents differences in authenticity, source credibility, perceived humanness, and marketing outcomes between human and virtual influencers [8]–[12]. However, evidence remains dispersed across separate outcomes. In particular, previous studies have not adequately established whether the integrated credibility → parasocial relationship (PSR) → consumer-brand engagement (CBE) → purchase intention pathway differs at particular structural links between naturally occurring human- and virtual-influencer follower groups. A comparison of overall outcomes alone cannot locate the stage at which relational associations diverge.

This study addresses that gap by distinguishing PSR, a psychological bond directed toward the influencer, from CBE, a cognitive, affective, and behavioral relationship directed toward the endorsed brand. It tests their theoretically ordered serial indirect association and compares equivalent structural paths after measurement-invariance assessment. The novelty is twofold: first, the study specifies an influencer-level bonding stage and a subsequent brand-level engagement stage within one empirical model; second, it identifies the structural location of human–virtual differences rather than presuming that one influencer type is uniformly more effective. The research therefore asks whether credibility is associated with purchase intention through PSR and CBE and whether the credibility–PSR, PSR–CBE, CBE–purchase intention, and serial indirect associations differ between human and virtual influencer followers in East Kalimantan.

2. Literature Review and Hypothesis Development

Influencer credibility comprises consumers' evaluations of an endorser's expertise, trustworthiness, and attractiveness. Source-credibility research links these evaluations to trust and purchase-related responses [15]–[17]. For virtual influencers, perceived human-likeness, disclosure, sensory capability, and authenticity may qualify these associations [2], [3], [8]. Credibility may also relate to parasocial relationship (PSR), an enduring, one-sided sense of familiarity and emotional closeness toward a media persona. PSR should be distinguished from parasocial interaction, which concerns the impression of interaction during a particular exposure episode. Studies of influencer followers have linked credibility cues to PSR and consumer interest [4], [5], [22], [23]. On that basis, this study expects credibility to be positively associated with PSR (H1), and also retains direct credibility associations with consumer-brand engagement (H4) and purchase intention (H5).

The relational object changes when a follower moves from the influencer to the endorsed brand. Consumer-brand engagement (CBE) reflects cognitive, affective, and behavioral investment in that brand, rather than the follower's attachment to a persona [6], [7], [24], [29]. Previous work associates parasocial relationships and follower identification with engagement involving the endorsed brand [6]. Studies also link such engagement to purchase-related intention [7], [12], [24]. Consequently, PSR is hypothesized to be positively associated with CBE (H2), CBE with purchase intention (H3), and PSR directly with purchase intention (H6). Three distinct indirect routes are examined: credibility → PSR → purchase intention (H7a), credibility → CBE → purchase intention (H7b), and the serial credibility → PSR → CBE → purchase intention association (H7c). These theoretically ordered paths describe statistical mediation rather than demonstrated temporal causation.

Influencer type may condition specific links in this relational sequence. Compared with virtual personas, human influencers can offer lived experience and recognizable social cues; virtual influencers can offer controlled and consistent narratives but may face different assessments of authenticity [3], [8], [10], [19]. Comparative studies indicate mixed purchase-related outcomes rather than a uniform advantage for either type [8]–[11], [28]. Research on virtual influencers further connects credibility, content characteristics, and engagement with favorable consumer responses [11], [12], [25]–[27]. What remains less clear is whether perceived credibility relates to PSR with equal strength in the two follower groups, and whether any difference also appears in the sequential indirect association with purchase intention. Accordingly, this study tests group differences in the credibility → PSR path (H8) and the serial indirect association (H9), while examining the remaining paths as additional comparisons. Measurement invariance is assessed before the group coefficients are contrasted.

3. Method

Research Design and Comparative Logic

The study used a cross-sectional, explanatory, known-groups survey to estimate the proposed associations among influencer credibility (CRED), parasocial relationship (PSR), consumer-brand engagement (CBE), and purchase intention (PI). Respondents were classified into naturally occurring human- and virtual-influencer follower groups, and the same measurement and structural specifications were applied to both groups. Group membership was not experimentally assigned; therefore, structural coefficients and between-group differences are interpreted as associations rather than causal effects.

The follower-based approach was chosen because PSR denotes an enduring perceived relationship that plausibly develops through repeated exposure, which a single-exposure experimental stimulus may not capture. Each respondent assessed one influencer they had followed or viewed repeatedly and one brand that the same influencer had recently endorsed. This common focal-object procedure was intended to reduce ambiguity about whether questionnaire responses referred to the influencer or the brand.

Population, Sampling Strategy, and Sample Adequacy

The target population consisted of adult Instagram and/or TikTok users residing in East Kalimantan who had repeatedly encountered commercial influencer content. Because no complete sampling frame of virtual-influencer followers was available, quota-based purposive sampling was used. Survey invitations were circulated through university, professional, community, and social-media networks in Samarinda, Balikpapan, Kutai Kartanegara, Bontang, and other accessible East Kalimantan localities. Recruitment sought representation across age groups, genders, and dominant platforms without claiming probability-based selection. Accordingly, the sample should not be interpreted as statistically representative of all regional social-media users.

Five eligibility criteria were applied: respondents were (1) at least 18 years old; (2) resident in East Kalimantan for at least one year; (3) active users of Instagram and/or TikTok; (4) followers or repeated viewers of the nominated influencer for at least three months; and (5) exposed to at least one endorsement of the nominated brand or product within the preceding three months. The exposure requirements were intended to make the PSR measure pertinent to an established follower–influencer relationship rather than incidental contact. Participants identified the focal influencer and brand before completing the construct measures.

The sample-size plan specified approximately 225 respondents in each influencer group. The reported a priori calculation assumed four predictors, $\alpha = 0.05$, power = 0.95, and a medium effect size ($f^2 = 0.15$),

corresponding to an estimated minimum of approximately 129 observations per group. After screening, 450 usable responses were retained (225 human and 225 virtual; Section 4.1). Exceeding this planning threshold supports the adequacy of the intended sample size, although power for specific paths and between-group indirect-effect differences depends on their actual magnitudes and sampling distributions.

Focal Influencer, Focal Brand, and Group Classification

Each respondent identified one focal influencer and one brand that the influencer had endorsed within the preceding three months. Human influencers were defined as identifiable living individuals with established offline identities. Virtual influencers were defined as persistent digitally constructed personas presented as independent social-media identities. Brand mascots, one-off AI-generated images, and avatars directly representing identifiable human creators were excluded from the virtual category. The same measurement questions were administered to both groups.

Respondents supplied the focal influencer's public social-media account and the relevant endorsed brand. Two independent coders classified the accounts using publicly available profiles, account characteristics, and origin-disclosure cues. Disagreements were referred to a third reviewer; cases remaining ambiguous were excluded rather than assigned arbitrarily. The reported inter-coder agreement was Cohen's $\kappa = 0.91$, and 12 cases were removed because an unambiguous classification could not be established. This verification procedure was intended to reduce misclassification between the two analytically distinct groups.

The focal-object instructions also distinguished the targets of the proposed mediators. PSR items referred exclusively to the selected influencer, whereas CBE and purchase-intention items referred to the endorsed brand or product. This separation operationalized influencer-directed relational closeness and brand-directed engagement as different constructs, although their theoretically proposed order cannot be established from the single-wave survey.

Instrument Development and Construct Operationalization

The questionnaire adapted established measures of influencer credibility, parasocial relationship, consumer-brand engagement, and purchase intention to a consistent focal-influencer/focal-brand format. It contained 30 indicators: four each for expertise, trustworthiness, and attractiveness; five for PSR; nine for CBE; and four for purchase intention. Items were administered on seven-point Likert-type response scales. The instrument sources and measurement focus are reported in Table 1.

The instrument-development protocol described forward translation into Indonesian, independent back-translation, and reconciliation by bilingual academics to address semantic and conceptual equivalence. Expert review in digital marketing and consumer behavior was included to examine content relevance. A preliminary pilot stage involving approximately 40–50 eligible respondents was specified to assess the clarity and contextual suitability of the questionnaire. Because pilot-stage outcomes are not documented in the available study report, no pilot-based reliability estimates or item revisions are claimed; measurement evidence for the final questionnaire is presented in Section 4.2.

Influencer credibility was specified as a higher-order composite comprising three reflective lower-order dimensions: expertise (EXP1–EXP4), trustworthiness (TRU1–TRU4), and attractiveness (ATT1–ATT4). PSR captured familiarity, perceived closeness, and emotional connection with the focal influencer. CBE captured cognitive, affective, and behavioral investment in the focal brand, and purchase intention covered reported likelihood, willingness, intention, and purchasing plans. The distinction between influencer-centered and brand-centered measurement targets was retained throughout the instrument.

Table 1. Construct operationalization and item structure

Construct	Item codes	No. of items	Measurement focus	Primary source
Expertise	EXP1-EXP4	4	Knowledge, competence, experience, and qualification attributed to the focal influencer.	Weismueller et al. (2020)
Trustworthiness	TRU1-TRU4	4	Perceived honesty, dependability, sincerity, and trustworthiness of the focal influencer.	Weismueller et al. (2020)
Attractiveness	ATT1-ATT4	4	Perceived attractiveness, appeal, style, and likeability of the focal influencer.	Weismueller et al. (2020); Kim & Wang (2024)
Parasocial Relationship	PSR1-PSR5	5	Familiarity, closeness, emotional connection, concern, and perceived knowing of the focal influencer.	Yuan & Lou (2020)
Consumer-Brand Engagement	CBE1-CBE9	9	Cognitive, affective, and behavioral investment in the focal endorsed brand.	Lourenço et al. (2022) [29]
Purchase Intention	PI1-PI4	4	Likelihood, willingness, intention, and plan to purchase the focal brand/product.	Sokolova & Kefi (2020)

Data Collection, Ethics, and Data-Quality Control

The online survey followed a defined sequence: informed-consent information and eligibility screening, identification of the focal influencer and recently endorsed brand, and completion of the 30 construct items. The questionnaire was circulated through the networks identified in Section 3.2. The screening and focal-object questions preceded the construct items so that each respondent's eligibility and reference objects could be established before the principal measurements were recorded.

Participation was voluntary, respondents could discontinue the questionnaire, and personally identifying details were not included in the analytical dataset. Responses were screened for unclear influencer classification, failed attention checks, straight-lining or implausibly short completion times, duplicate submissions, and substantial missing information. The corresponding exclusions and final group sizes are presented in Section 4.1 and Table 3. This procedure addressed readily observable data-quality concerns, although it could not eliminate every source of self-report bias.

The informed-consent and confidentiality procedures are described above. No institutional ethics-committee approval number or formal exemption determination is documented in the manuscript materials; therefore, the article does not assert that such clearance was obtained. Any applicable institutional determination should be confirmed by the authors and reported in accordance with the journal's ethical requirements.

Data Analysis: PLS-SEM, Serial Mediation, and Human–Virtual Comparison

Data were analyzed using partial least squares structural equation modeling (PLS-SEM) in SmartPLS 4. The model incorporated a higher-order credibility composite, two intervening constructs, purchase intention as the final outcome, and a comparison between naturally occurring influencer groups. The analysis comprised measurement-model assessment, disjoint two-stage estimation of higher-order credibility, structural and

bootstrapped indirect-path assessment, Measurement Invariance of Composites (MICOM), permutation-based multi-group analysis, and predictive and robustness checks [13], [14].

Reflective indicators were assessed using loading magnitudes, internal-consistency statistics (Cronbach's alpha, rho_A, and composite reliability), average variance extracted (AVE), and the heterotrait-monotrait ratio (HTMT). Preferred loading and reliability benchmarks were approximately 0.708 and 0.70–0.95, respectively; AVE above 0.50 was used for convergent validity. HTMT below 0.85 was treated as a conservative standard, with 0.90 as a practical upper bound where constructs were closely related. The hierarchical credibility composite was evaluated by a disjoint two-stage procedure and inspected for collinearity across expertise, trustworthiness, and attractiveness.

The structural model retained direct paths alongside the specified indirect routes. The reported assessment used standardized path coefficients, inner-model variance inflation factors (VIF), 10,000 bootstrap resamples, 95% confidence intervals, explained variance (R^2), and effect sizes (f^2). Its path equations were:

$$\begin{aligned} PSR &= a_1(CRED) + \varepsilon_1 \\ CBE &= a_2(CRED) + d_{21}(PSR) + \varepsilon_2 \\ PI &= c'(CRED) + b_1(PSR) + b_2(CBE) + \varepsilon_3 \end{aligned}$$

The focal serial indirect coefficient was defined as $a_1 \times d_{21} \times b_2$. Two shorter specific indirect associations, $CRED \rightarrow PSR \rightarrow PI$ and $CRED \rightarrow CBE \rightarrow PI$, were also tested. A bootstrap 95% confidence interval excluding zero was taken as statistical support for an indirect association. Because all constructs were measured cross-sectionally, the proposed mediator sequence is theory-driven and does not establish temporal ordering or causal mediation.

MICOM was applied before comparing structural estimates between the human and virtual groups. Configural and compositional invariance were required for interpretable MGA comparisons; equality of composite means and variances was examined separately. Once at least partial invariance was established, permutation-based MGA was used to compare the two sets of coefficients, including the serial indirect association. PLS-MGA was described as a complementary sensitivity procedure. The reported comparative estimates are summarized in Section 4.6.

Because exposure groups were self-selected, the analysis also considered differences in age, gender, education, platform and social-media use, exposure frequency, brand familiarity, prior brand purchase, and product-category involvement. Adjusted models incorporated these observable covariates. Such adjustments can assess the stability of results to measured imbalances but cannot eliminate confounding by unmeasured differences between groups.

Predictive performance was examined using PLSpredict and $Q^2_{predict}$ for indicators of the three endogenous constructs. Prediction errors from the PLS model were compared with a linear-model benchmark. Reporting emphasized effect sizes and interval estimates in addition to statistical significance. Table 2 summarizes the analysis sequence and the associated interpretive criteria.

Table 2. Final analytical sequence and decision criteria

Stage	Assessment	Decision rule / interpretation
Sample adequacy	A priori power and sensitivity	Minimum $\approx 129/\text{group}$ for $f^2=.15$; sample 225/group (reported sensitivity) detects $\approx f^2=.084$ at power=.95.
Reflective measurement	Loadings, α , rho_A, CR, AVE, HTMT	Establish reliability, convergent validity, and discriminant validity before interpreting paths.

Stage	Assessment	Decision rule / interpretation
Higher-order credibility	Two-stage HCM; VIF; weights/loadings	Retain theoretically necessary dimensions unless both conceptual and empirical support are inadequate.
Structural model	VIF, β , 10,000-bootstrap CI, R^2 , f^2	Interpret magnitude and uncertainty, not p-values alone.
Serial mediation	Specific and serial indirect effects	95% bootstrap CI must exclude zero; avoid causal overstatement.
Common method bias	Procedural remedies + full-collinearity VIF	VIF < 3.3 used as supplementary diagnostic.
Measurement invariance	MICOM	At least partial invariance required before MGA.
Human vs. virtual comparison	Permutation MGA + PLS-MGA	Compare equivalent paths and the serial indirect effect only after MICOM.
Robustness selection	/ Covariates and standardized differences	Core conclusions should remain substantively stable.
Prediction	PLSpredict; Q^2_{predict}	Evaluate out-of-sample predictive relevance against linear benchmark.

4. Results and Discussion

Data Screening and Respondent Profile

A total of 485 questionnaires met the initial eligibility screening; 35 were excluded before model estimation. Exclusions comprised 12 cases with unresolved influencer classification, eight failed attention checks, seven cases of straight-lining or implausibly short response times, five duplicates, and three cases with substantial missing information. The final dataset contained 450 usable responses, evenly divided between human-influencer ($n = 225$) and virtual-influencer ($n = 225$) followers. Agreement between the two account-classification coders was high (Cohen's $\kappa = 0.91$).

Respondent characteristics were broadly similar across the two groups on the descriptive measures presented in Table 3, including age, gender, preferred platform, and daily social-media use. However, similarity on these observed characteristics does not establish equivalence between naturally occurring groups. The sensitivity analyses therefore incorporated additional observed covariates to assess whether the principal between-group results were robust to measured imbalances (Section 4.7).

Table 3. Respondent profile and screening summary

Indicator	Human	Virtual	Total / difference
Usable respondents (n)	225	225	450
Mean age (years)	27.9	26.8	$\Delta = 1.1$
Female (%)	55.1	52.4	$\Delta = 2.7$ pp
Instagram dominant (%)	61.3	64.0	$\Delta = -2.7$ pp
TikTok dominant (%)	38.7	36.0	$\Delta = 2.7$ pp
Mean daily social-media use (hours)	4.61	4.88	$\Delta = -0.27$
Verified influencer classification	100%	100%	$\kappa = 0.91$

Measurement Model

Measurement quality was examined before structural relationships were interpreted. As summarized in Table 4, pooled indicator loadings exceeded 0.75, the reported composite reliability coefficients ranged Human or Virtual? Comparing How Influencer Credibility Shapes Purchase Intention through Parasocial Relationship and Consumer-Brand Engagement in East Kalimantan, Indonesia. Purwinahyu et.al

from 0.885 to 0.941, and AVE exceeded 0.50 for all constructs. Group-specific composite reliability and AVE also met the reported thresholds. These results support convergent validity and internal consistency within the analyzed sample, subject to confirmation against the original item-level measurement output.

Table 4. Reliability and convergent validity: pooled and group-specific assessment

Construct	Loading range	Pooled CR	Pooled AVE	Human CR / AVE	Virtual CR / AVE
Expertise	0.810-0.861	0.903	0.699	0.901 / 0.695	0.905 / 0.703
Trustworthiness	0.842-0.887	0.924	0.753	0.922 / 0.748	0.926 / 0.758
Attractiveness	0.785-0.836	0.885	0.659	0.882 / 0.652	0.888 / 0.666
Parasocial Relationship	0.793-0.861	0.918	0.692	0.921 / 0.699	0.914 / 0.684
Consumer-Brand Engagement	0.762-0.853	0.941	0.640	0.943 / 0.644	0.939 / 0.636
Purchase Intention	0.849-0.884	0.924	0.754	0.925 / 0.757	0.922 / 0.750

Discriminant validity was assessed using HTMT. The highest pooled HTMT was 0.789 (CBE and purchase intention), with group maxima of 0.802 among human-influencer followers and 0.781 among virtual-influencer followers; these values were below 0.90 (Table 5). Reported full-collinearity VIF values ranged from 1.49 to 2.31, indicating no pronounced collinearity under that diagnostic. However, collinearity checks alone cannot establish the absence of common-method bias in a single-source cross-sectional survey.

Table 5. HTMT discriminant validity (pooled sample)

Construct	EXP	TRU	ATT	PSR	CBE	PI
Expertise	—					
Trustworthiness	0.731	—				
Attractiveness	0.614	0.668	—			
PSR	0.583	0.642	0.571	—		
CBE	0.521	0.608	0.548	0.754	—	
Purchase Intention	0.487	0.566	0.512	0.701	0.789	—

Higher-Order Influencer Credibility

The disjoint two-stage specification supported the higher-order credibility construct. Trustworthiness contributed the largest relative weight to overall credibility ($w = 0.438$), followed by expertise ($w = 0.347$) and attractiveness ($w = 0.284$). All outer weights were statistically different from zero and VIF values were below 2.00.

Table 6. Higher-order credibility assessment

Dimension	Weight	t	p	VIF
Expertise → Credibility	0.347	8.42	<0.001	1.74
Trustworthiness → Credibility	0.438	10.95	<0.001	1.91
Attractiveness → Credibility	0.284	6.88	<0.001	1.68

Structural Model and Hypothesis Tests

The structural model was assessed using 10,000 bootstrap resamples. All six specified direct path coefficients were positive and statistically significant (Table 7). Credibility was most strongly associated with PSR ($\beta = 0.472$, $t = 11.84$, $p < 0.001$), whereas CBE had the largest direct coefficient in the purchase-intention equation ($\beta = 0.517$, $t = 11.68$, $p < 0.001$). PSR was positively associated with CBE ($\beta = 0.392$, $t = 8.73$, $p < 0.001$). The remaining direct paths were smaller but statistically supported. These estimates represent associations under the specified cross-sectional model rather than causal effects.

The reported explained variance for PSR was $R^2 = 0.223$, consistent with the standardized credibility–PSR association. The reported incremental effect sizes were greatest for CBE → purchase intention ($f^2 = 0.361$), credibility → PSR ($f^2 = 0.286$), and PSR → CBE ($f^2 = 0.184$). The other two endogenous R^2 estimates are not presented here because their correspondence with the reported structural coefficients has not been established from the available SmartPLS documentation. Thus, conclusions about overall explanatory power for CBE and purchase intention should await verification of the original output.

Table 7. Direct structural relationships and hypothesis test results

Hyp.	Path	β	t	p	95% CI	f^2	Decision
H1	CRED → PSR	0.472	11.84	<0.001	[0.391, 0.549]	0.286	Supported
H2	PSR → CBE	0.392	8.73	<0.001	[0.304, 0.476]	0.184	Supported
H3	CBE → PI	0.517	11.68	<0.001	[0.431, 0.598]	0.361	Supported
H4	CRED → CBE	0.184	4.21	<0.001	[0.098, 0.267]	0.045	Supported
H5	CRED → PI	0.108	2.41	0.016	[0.021, 0.195]	0.018	Supported
H6	PSR → PI	0.142	3.07	0.002	[0.053, 0.233]	0.029	Supported

Table 7 presents the complete set of reported direct path estimates, confidence intervals, and effect sizes. Credibility → purchase intention ($\beta = 0.108$) and PSR → purchase intention ($\beta = 0.142$) remained statistically supported despite their relatively small coefficients, making it important to examine the indirect paths alongside the direct associations.

Indirect and Serial Mediation Effects

The specific indirect associations were statistically supported (Table 8). The focal credibility → PSR → CBE → purchase intention coefficient was $\beta = 0.096$ (95% CI [0.064, 0.131]); the shorter indirect associations through PSR alone and CBE alone were $\beta = 0.067$ and $\beta = 0.095$, respectively. The direct credibility → purchase intention association remained statistically significant ($\beta = 0.108$, $p = 0.016$). This combination is consistent with complementary partial statistical mediation under the specified cross-sectional model; it does not demonstrate the chronological or causal transmission of credibility through the proposed mediators.

Table 8. Indirect effects

Hyp.	Indirect effect	β	t	p	95% CI	Decision
H7a	CRED → PSR → PI	0.067	3.26	0.001	[0.028, 0.111]	Supported
H7b	CRED → CBE → PI	0.095	4.36	<0.001	[0.049, 0.143]	Supported
H7c	CRED → PSR → CBE → PI	0.096	5.74	<0.001	[0.064, 0.131]	Supported

Measurement Invariance and Human-Virtual Comparison

MICOM supported configural and compositional invariance for credibility, PSR, CBE, and purchase intention (Table 9). Equality of composite means was not established for credibility and PSR, whereas equality of means and variances was reported for CBE and purchase intention. Accordingly, at least partial invariance was established for the compared composites. This supports comparison of structural estimates while distinguishing it from claims about equal construct means.

Table 9. MICOM results

Composite	Configural	Compositional	Equal means	Equal variances	Conclusion
Credibility	Yes	Yes	No	Yes	Partial invariance
PSR	Yes	Yes	No	Yes	Partial invariance
CBE	Yes	Yes	Yes	Yes	Full invariance
Purchase Intention	Yes	Yes	Yes	Yes	Full invariance

Permutation-based MGA showed two statistically significant group differences (Table 10). The credibility → PSR coefficient was higher in the human-influencer group ($\beta = 0.548$) than in the virtual-influencer group ($\beta = 0.391$; $\Delta\beta = 0.157$, $p = 0.008$). The serial indirect association was also higher for human influencers ($\beta = 0.116$ vs. 0.071 ; $\Delta\beta = 0.045$, $p = 0.021$). By contrast, PSR → CBE ($p = 0.112$), CBE → purchase intention ($p = 0.614$), and the other reported direct paths did not differ significantly. Thus, the observed cross-group distinction is most clearly located at the credibility–PSR link, not the final CBE–intention link.

Table 10. Multi-group comparison

Hyp.	Path/effect	Human	Virtual	Δ	Permutation p	Decision
H8	CRED → PSR	0.548	0.391	0.157	0.008	Difference supported
H9	Serial indirect effect	0.116	0.071	0.045	0.021	Difference supported
—	CRED → CBE	0.156	0.211	-0.055	0.278	No difference
—	PSR → CBE	0.421	0.342	0.079	0.112	No difference
—	CRED → PI	0.081	0.132	-0.051	0.304	No difference
—	PSR → PI	0.159	0.118	0.041	0.412	No difference
—	CBE → PI	0.503	0.531	-0.028	0.614	No difference

Predictive Assessment and Robustness Checks

Q^2_{predict} was positive for the reported endogenous indicators. Relative to a linear benchmark, the PLS model yielded lower prediction errors for four of five PSR items, seven of nine CBE items, and all four purchase-intention items (Table 11). These results suggest predictive usefulness across the examined outcomes, although the predictive labels should be interpreted in relation to the reported item-level comparison rather than as a guarantee of performance in other samples.

Table 11. PLSpredict summary

Endogenous construct	Q^2_{predict} range	PLS vs. linear benchmark	Assessment
PSR	0.181-0.264	Lower error: 4/5 indicators	Moderate
CBE	0.248-0.391	Lower error: 7/9 indicators	Moderate-high
Purchase Intention	0.362-0.447	Lower error: 4/4 indicators	High

With observed covariates included, the credibility → PSR difference remained statistically supported (adjusted $\Delta\beta = 0.149$, $p = 0.011$), as did the serial indirect-effect difference (adjusted $\Delta = 0.042$, $p = 0.027$). No reversal in the reported direction of the principal paths occurred. These results indicate stability with respect to the measured controls, although unobserved differences between the non-randomized groups may still affect the estimates.

Credibility and the Influencer-Level Bond

Credibility was more strongly associated with PSR ($\beta = 0.472$) than directly with purchase intention ($\beta = 0.108$), indicating that its principal relationship within this model appears at the influencer-level bonding stage. This distinction adds precision to source-credibility accounts, which connect evaluations of expertise, trustworthiness, and attractiveness to trust and purchase-related responses [15]–[17]. The higher-order results further ranked trustworthiness ($w = 0.438$) ahead of expertise ($w = 0.347$) and attractiveness ($w = 0.284$). These weights suggest that perceived honesty and sincerity are especially salient components of the specified credibility composite, rather than showing that any one component causally determines consumers' relationships.

The emphasis on trustworthiness is consistent with Indonesian evidence showing positive expertise–PSR and trustworthiness–PSR associations among beauty-influencer followers [5]. For virtual influencers, authenticity, disclosure, and human-like cues may complicate credibility assessments [2], [3], [8], [19]. Earlier studies establish that AI personas can occupy endorsement roles and cultivate social-media Human or Virtual? Comparing How Influencer Credibility Shapes Purchase Intention through Parasocial Relationship and Consumer-Brand Engagement in East Kalimantan, Indonesia. Purwinahyu et.al

followings [20], [21]; the present results qualify that observation by showing that greater credibility is associated with stronger PSR in both follower groups, but the association is larger for human influencers. This interpretation concerns measured associations, not inherent limitations of artificial personas.

Serial Association: From Parasocial Bonding to Brand Engagement

The supported serial indirect association ($\beta = 0.096$, 95% CI [0.064, 0.131]) is consistent with the proposed two-stage relational structure. PSR captures the follower's perceived bond with the influencer, while CBE captures engagement with the endorsed brand. Earlier evidence connects credibility to parasocial processes [4], [22], [23], parasocial relationships to brand engagement [6], and brand engagement to purchase-related responses [7], [24]. By examining those distinct relationships in a common specification, the analysis makes clearer why a favorable evaluation of an influencer need not directly coincide with high brand engagement or purchase intention.

CBE showed the largest direct association with purchase intention ($\beta = 0.517$; $f^2 = 0.361$), while the shorter PSR-only and CBE-only indirect associations also remained supported. These findings complement virtual-influencer studies connecting credibility and engagement with buying-related outcomes [11], [12], [25]–[27]. They do not, however, establish that influencer attachment preceded brand engagement in time, because both constructs were measured in one survey. The proposed sequence is therefore best characterized as an empirically supported, theoretically ordered statistical pathway requiring longitudinal or experimental confirmation.

Human–Virtual Differences Are Concentrated at Relational Bonding

The main comparative contribution concerns the uneven distribution of group differences along the proposed chain. Credibility was more strongly associated with PSR for followers of human influencers ($\beta = 0.548$) than for followers of virtual influencers ($\beta = 0.391$, $p = 0.008$). The serial indirect association was also larger in the human group ($\beta = 0.116$ vs. 0.071 , $p = 0.021$). In contrast, the PSR $\rightarrow$ CBE ($p = 0.112$) and CBE $\rightarrow$ purchase intention ($p = 0.614$) differences were not statistically significant. This is more informative than a blanket claim that human influencers are superior: the evidence locates the clearest measured distinction at the influencer-level credibility–bonding association.

Comparative research has documented variation in authenticity, social presence, trust transfer, and purchase-related outcomes across human and virtual influencers [3], [8]–[10], [19], [28]. The current result is compatible with the possibility that human influencers' lived experiences provide stronger relational cues, whereas virtual personas must build continuity through deliberate storytelling and disclosure. That interpretation remains a theoretically informed explanation rather than a directly tested mechanism, because the present model did not separately estimate authenticity, perceived human-likeness, or disclosure effects. Moreover, the lack of a significant CBE $\rightarrow$ purchase intention difference should not be mistaken for proof that the two groups are statistically equivalent.

Predictive Relevance, Practical Implications, and Limitations

The item-level PLSpredict results suggest predictive usefulness relative to the specified linear benchmark for most indicators, particularly purchase intention. The regional context is also pertinent: expanding digital payments in East Kalimantan provide relevant market background, but are not direct evidence of influencer campaign effectiveness [1]. Accordingly, the predictive findings should not be generalized beyond similar respondent, brand, and platform settings without validation in new samples.

For brand managers, the stronger human credibility–PSR association suggests prioritizing trust cues, transparency, narrative consistency, and a recognizable persona identity when selecting or designing virtual endorsers [2], [19], [27]. As no statistically significant between-group difference was detected in the CBE–Human or Virtual? Comparing How Influencer Credibility Shapes Purchase Intention through Parasocial Relationship and Consumer-Brand Engagement in East Kalimantan, Indonesia. Purwinahyu et.al

purchase intention coefficient, campaigns involving either influencer type could also emphasize product information, brand-centered interaction, and appropriate demonstrations [7], [12], [24]–[26]. These are managerial implications inferred from observed associations, not intervention effects established experimentally.

The findings should be interpreted in light of the study's cross-sectional measurement, non-probability recruitment, naturally occurring group assignment, and focus on one Indonesian province. Although observed covariates were incorporated into robustness checks, residual confounding, common-method influences, and product-category heterogeneity cannot be ruled out. Follow-up longitudinal, experimental, and multi-region studies should test whether authenticity, anthropomorphism, disclosure, product–endorser fit, and prior brand familiarity explain the credibility–PSR difference or moderate the relationship between CBE and purchase intention [18], [28].

5. Conclusion

The findings support a theoretically ordered relational association linking influencer credibility, parasocial relationship (PSR), consumer-brand engagement (CBE), and purchase intention. Credibility was positively associated with PSR ($\beta = 0.472$), PSR with CBE ($\beta = 0.392$), and CBE with purchase intention ($\beta = 0.517$). The serial indirect association was statistically supported ($\beta = 0.096$, 95% CI [0.064, 0.131]). These results distinguish the perceived follower–influencer bond from engagement directed toward the endorsed brand and provide a more differentiated account than a single direct credibility–intention relationship.

The human–virtual comparison indicates that source type is associated with differences at particular relational stages rather than uniformly across the model. The credibility–PSR association was stronger among human-influencer followers ($\Delta\beta = 0.157$, $p = 0.008$), as was the serial indirect association ($\Delta\beta = 0.045$, $p = 0.021$). In contrast, CBE $\rightarrow$ purchase intention did not differ significantly between groups ($p = 0.614$). Practically, this pattern suggests emphasizing transparent, credible, and consistent relational cues for virtual endorsers while developing meaningful engagement with the endorsed brand for both influencer types.

Because the study is cross-sectional, non-randomized, and based on purposively recruited social-media users in East Kalimantan, these findings must not be interpreted as evidence of temporal or causal mediation. Future research should use longitudinal or experimental designs, verify the mechanisms associated with human-likeness and authenticity, and replicate the group comparison across product categories, platforms, and regions. The central contribution is the identification of where the observed human–virtual association differs within a theoretically specified two-stage relational model.

6. References

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