EPISTEMOLOGICAL BELIEFS ABOUT DIGITAL TOOLS: A COMPARATIVE STUDY OF MOROCCAN PROSPECTIVE TEACHERS ACROSS TRAINING CYCLES

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Abstract

This study investigates the personal epistemological beliefs of Moroccan prospective teachers about three families of digital tools, social networks, trainers' personal blogs, and institutional portals and compares the beliefs of prospective primary teachers (N = 56) with those of prospective secondary teachers (N = 114) enrolled at the Regional Center for Education and Training (CRMEF) in Meknes. Drawing on Hofer and Pintrich's four-dimensional model (certainty, simplicity, source, justification of knowledge), data were collected with a 5-point Likert questionnaire and analyzed using both descriptive and inferential statistics. Reliability analysis revealed that, in its current form, the instrument does not reach the conventional threshold of α = .70 for an aggregated score (α = .59 raw; α = .41 after reverse-coding), but exploratory factor analysis identified a more granular seven-factor structure that refines the original four-dimension model. Mann-Whitney U tests on the 19 items common to both cycles, with Benjamini-Hochberg correction for multiple comparisons, revealed that the two groups converge on 18 of the 19 items: composite scores on the four sub-dimensions do not differ significantly ($|d| \leq .24$). A single item, related to deference to the online responder when their content conflicts with personal experience, distinguishes the two cycles (M = 1.96 vs 2.63; p_FDR = .003; r = .28), with prospective secondary teachers showing greater reliance on external online authority. Within the secondary sample, the discipline of training has a small but significant effect on the global epistemological score ($\eta^2 = .045$), whereas gender does not. The most striking result is the cross-cycle convergence consistent with the slow pace of epistemic change during initial training together with a localized difference on a Source-of-knowledge item rather than on Justification. Implications for teacher training and for instrument refinement are discussed.

Keywords: epistemological beliefs personal epistemology digital culture prospective teachers teacher training.

1. INTRODUCTION

The discourse of Moroccan educational policy treats teacher training as a key indicator of every reform [1]. Within this institutional context, research on the digital practices and beliefs of prospective teachers remains limited. [2] reports that searching for information online is widespread among prospective teachers, whose declared digital practices reveal facility with the technical, social and informational dimensions of ICT but more limited mastery of pedagogical uses. In a study characterizing the digital culture of prospective primary school teachers, [3] showed that this culture is rooted in personal uses of digital tools and resources, with frequent recourse to social networks and a low tendency to use institutional platforms. These observations led the authors of the present line of work to investigate not the practices themselves but the epistemological beliefs that prospective teachers hold about the kinds of knowledge constructed through three specific families of tools: social networks, trainers' personal blogs, and institutional portals.

Personal epistemology has been the object of considerable research [4,5,6,7,8,9]; it is recognized as a construction that significantly affects teachers' practices and their integration of technology [10,18,19,20] and informs how they conceive of training programs [17]. [11] explored the epistemological beliefs of prospective secondary teachers and showed that initial training plays a role in refining these beliefs. In Morocco, however, no published study had so far compared the beliefs of prospective teachers of primary and secondary education using a unified methodology applied to the same training center.

The present article reports on such comparative study. Three methodological choices structure the analysis:

1) The construct measured is framed explicitly as epistemological beliefs about digital tools rather as a general “digital culture”, to avoid the conflation between observed practices [3] and self-reported beliefs that a broad framing would invite.
2) The data are analyzed with inferential statistics: Mann-Whitney U test on the 19 items common to the two questionnaires, with Benjamini-Hochberg [22] correction for multiple comparisons, composite scores by dimension, and an exploratory factor analysis.
3) The reliability of the instrument is reported transparently by sub-dimension and discussed as a limitation rather than treated as a settled property of the scale.

Two research questions are addressed:

- RQ1. What epistemological beliefs about social networks, trainers' personal blogs and institutional portals do prospective secondary teachers express at the CRMEF Meknes?
- RQ2. How do these beliefs compare, item by item and dimension by dimension, to those of prospective primary teachers from the same training center reported by Zaid, Ou-sekou and Kaddari [12]?

2. THEORETICAL FRAMEWORK

Following Hofer and Pintrich [13], personal epistemology is the system of beliefs and theories that an individual develops about knowledge and the process of knowing. The model distinguishes two main dimensions the nature of knowledge and the nature of the act of knowing, each subdivided into two sub-dimensions: certainty and simplicity of knowledge on the one hand, source and justification of knowledge on the other (Figure 1). Each sub-dimension was adapted in our instrument to the three digital tools under study, following the strategy of [3] for the primary cycle.

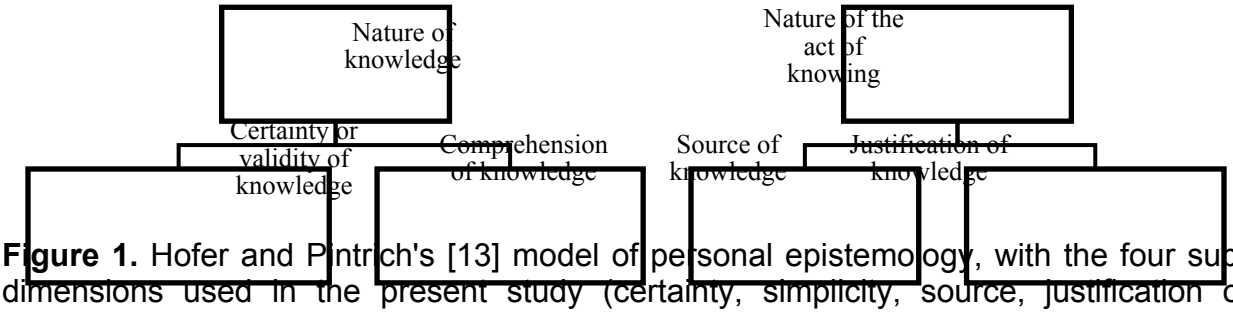

Figure 1. Hofer and Pintrich's [13] model of personal epistemology, with the four sub-dimensions used in the present study (certainty, simplicity, source, justification of knowledge), each operationalized for social networks, trainers' personal blogs and institutional portals

Two specifications inherited from prior work need to be made explicit here. First, recent literature on Internet-specific epistemic beliefs [14,15] argues that beliefs about online knowledge can decompose into finer facets than the four canonical Hofer-Pintrich dimensions. This observation provides a theoretical anchor for exploration factor analysis. Second, the distinction between the present construct beliefs about three families of digital tools and the broader notion of «digital culture» as used by [3] should not be obscured: the latter denotes observed practices, the former self-reported beliefs about the cognitive status of contents accessed through specific tools. This distinction is maintained throughout the article.

3. METHOD

3.1. Participants

Two samples of prospective teachers enrolled at the CRMEF of Meknes (Morocco) were analyzed. The primary-cycle sample (N = 56; 73.2 % female, 26.8 % male; modal age

26–30 years) corresponds to the data reported in [12]. The secondary-cycle sample (N = 114; 50.0 % female, 50.0 % male; modal age 20–25 years) was collected with the same questionnaire. Within the secondary sample, three broad disciplines of training are represented: sciences and techniques (n = 55, 48.2 %), human sciences (n = 48, 42.1 %), and economics and management (n = 11, 9.6 %). Sixty-four percent of the secondary participants had no prior teaching experience; the remainder reported up to one year (15.8 %) or more (15 participants). The deliberate decision to compare two cohorts trained in the same regional center neutralizes several institutional confounds (selection process, training modules, teaching staff) and is one of the design strengths of the comparative analysis, but it limits generalizability to other regional centers.

3.2. Instrument

The instrument is a self-administered questionnaire derived from the four-dimensional model of [13] and adapted to the three digital tools targeted by the study. The primary-cycle version contains 20 items; the secondary-cycle version contains 19 items, which are common to both questionnaires. One item present in the primary version (just_exp_VS_exper) is absent from the secondary version.

This asymmetry justifies restricting all inter-cycle comparisons to the common items, justifies restricting all inter-cycle comparisons to the 19 common items. Each item is rated on a five-point Likert scale ranging from 1 = «strongly disagree» to 5 = «strongly agree», with 3 = «neutral» as the midpoint.

Ten items are theoretically formulated in the direction of «naive» beliefs (high score = naive belief) and were intended to be reverse-coded so that, on a unified scale, a high score indicates a more sophisticated belief. The empirical behavior of these items does not match the intended polarity, and we therefore present results both with and without reverse-coding, and we treat scale construction as exploratory rather than confirmatory.

3.3. Procedure

A paper version of the questionnaire was distributed in person at the CRMEF Meknes. To minimize bias, the researchers provided standardized Arabic explanations for Francophone participants and addressed item ambiguities in real time. Anonymity was ensured. The completed questionnaires were entered into SPSS (version 23) and re-analyzed with Python (pandas, scipy, statsmodels) for the inferential analyses.

3.4 Analytic plan

The analysis is organized into four steps, each addressing a distinct methodological requirement of comparative design:

- Reliability. Cronbach's α is computed per sub-dimension and globally, in raw coding and after reverse-coding, with item-total corrected correlations and the change in α if each item is removed.
- Item-by-item inter-cycle comparison. The Mann-Whitney U test is used in preference to Student's t because of the ordinal nature of the Likert scale and the non-normality of the Simplicity dimension (Shapiro-Wilk, $p < .01$ in both groups). The 19 p-values are corrected using the Benjamini-Hochberg [22] false discovery rate (FDR) procedure to control multiple-comparison inflation.
- Composite scores by sub-dimension. After reverse-coding (so that higher = more sophisticated), means and standard deviations are reported for each sub-dimension, with Welch's t-test, Mann-Whitney U, Cohen's d and r as effect sizes.
- Exploratory factor analysis (EFA). To understand the moderate reliability of the aggregated score and to test whether the four-dimensional Hofer-Pintrich structure is recovered empirically on our 19 items, a principal-component analysis with Varimax rotation was conducted on the combined sample (N = 170).
- Demographic effects within the secondary sample (gender, discipline of training) were tested with Mann-Whitney U and Kruskal-Wallis H, respectively.

4. RESULTS:

4.1. Descriptive results: profiles of beliefs of prospective secondary teachers

This section addresses RQ1. To stay close to the data and to avoid overinterpretation, results are reported as item means with their standard deviations on the original five-point scale; reverse-coded composite means are reported separately in further Section.

4.1.1. Certainty of knowledge

Concerning the questioning of online content, prospective secondary teachers tend to declare a critical stance toward social media content (M = 3.81, SD = 1.20), while remaining neutral with respect to trainers' personal blogs (M = 3.48, SD = 1.07) and institutional portals (M = 3.21, SD = 1.34). When the question turns to consistency with scientific principles, the means fall below the neutral midpoint for both social networks (M = 2.46, SD = 1.20) and personal blogs (M = 2.51, SD = 1.13), indicating that participants tend to consider that content on these platforms does not systematically align with established scientific principles.

4.1.2. 4.1.2 Simplicity (comprehension) of knowledge

Prospective secondary teachers report that contents on social networks (M = 2.31, SD = 1.04), on trainers' blogs (M = 2.58, SD = 1.04) and on student blogs (M = 2.41, SD = 0.96)

are not particularly difficult to understand. The three means fall in the «disagree» zone of the scale, indicating perceived comprehensibility of the contents accessed through these tools.

4.1.3. 4.1.3 Source of knowledge

Two distinct patterns emerge in the Source sub-dimension. On the one hand, accepting content without understanding it is rejected, both for social networks (M = 2.00, SD = 1.04) and for personal blogs (M = 2.02, SD = 1.00). On the other hand, beliefs concerning the truth value of online content vary: prospective secondary teachers do not consider social-network articles to be automatically true (M = 2.26, SD = 1.13), while beliefs about blog content are more nuanced (M = 2.82, SD = 1.16). A particular item referring to the online responder when their content conflicts with one's own experience yields a higher mean (M = 2.63, SD = 1.22) than the corresponding mean in the primary sample (M = 1.96).

4.1.4. 4.1.4 Justification of knowledge

On the question of whether content on social networks rests on principles, the mean is below the midpoint (M = 2.89, SD = 1.31). Means for the consensus/expert items (just_RS_cons_exper M = 2.96; just_BP_cons_exper M = 3.06) and for the criteria of evaluation items (just_VF_RS M = 2.73; just_VF_BP M = 2.72) cluster near the neutral zone, indicating moderate engagement with explicit justification criteria when assessing online content.

4.2. Inferential results: comparison between cycles

This section addresses RQ2. Given the ordinal nature of the Likert scale and the non-normality of several distributions, group differences are tested with inferential statistics rather than reported as descriptive frequences alone.

4.2.1. 4.2.1 Reliability of the instrument

Cronbach's α was computed per sub-dimension and globally, in raw coding and with the theoretically expected reverse-coding (Table 1).

Table 1. Cronbach's α by sub-dimension and sample.

Sub-dimension	k	α Primary (raw)	α Secondary (raw)	α Combined (raw)	α Combined (recoded)
Certainty	5	.28	.44	.39	.47
Simplicity	3	.62	.50	.54	.54
Source	6	.54	.54	.54	.54
Justification (common items)	5	.69	.60	.64	.21
GLOBAL	19	.63	.57	.59	.41

Note. Reverse coding was applied to the ten items theoretically formulated in the «naive» direction. The decrease in α after reverse-coding (especially massive for Justification: .64 → .21) shows that these items correlate positively with the rest of the scale in their raw direction, contrary to the theoretical expectation. None of the global α values reaches the .70 threshold conventionally recommended by Nunnally and Bernstein [21].

A global α of .613 falls below the conventional threshold of .70 recommended by Nunnally and Bernstein [21]; the instrument is therefore treated as exploratory rather than as a validated composite score throughout the present analyses. We report a diagnostic at the item level: three items show a corrected item-total correlation that is null or negative (sour_exp_VS_autre r = −.00; just_RS_princip r = −.06; cert_contRS r = .08), and their removal would increase α. This is consistent with a heterogeneous instrument that does not reduce to a single «sophistication» score, a point we discuss in further section as a substantive limitation of the present scale and a target for future psychometric refinement.

4.2.2. 4.2.2 Item-by-item and dimension-by-dimension comparison

Mann-Whitney U tests on the 19 common items, with Benjamini-Hochberg correction (m = 19), are reported in Table 2. Out of 19 comparisons, a single one remains significant after correction: sour_exp_VS_autre («If my own experience conflicts with what is presented online by the responder, the responder is probably right»). Prospective secondary teachers endorse this statement more readily than prospective primary teachers (M = 2.63 vs M = 1.96; p < .001; p_FDR = .003; effect size r = .28, modest). All other inter-cycle differences are compatible with sampling noise.

Table 2. Item-by-item Mann-Whitney comparisons (raw coding) with Benjamini-Hochberg correction.

Item (short label)	Primary M (SD)	Secondary M (SD)	p (MW)	p (FDR)	r
cert_RS — Question social-media ideas	3.98 (1.12)	3.81 (1.20)	.370	.768	.07
cert_BPF — Question blog ideas	3.34 (0.98)	3.48 (1.07)	.433	.768	.06
cert_PI — Question institutional portals	3.21 (1.29)	3.21 (1.34)	.936	.993	.01
cert_contRS — Social-media content ≠ science	2.45 (1.18)	2.46 (1.20)	.761	.993	.02
cert_contBP — Blog content ≠ science	2.73 (1.30)	2.51 (1.13)	.274	.743	.08
simp_RS — Social media hard to understand	2.21 (1.18)	2.31 (1.04)	.883	.993	.01
simp_BP — Trainer blogs hard to understand	2.54 (1.04)	2.58 (1.04)	.962	.993	.00
simp_BE — Student blogs hard to understand	2.36 (0.93)	2.41 (0.96)	.993	.993	.00
sour_RS — Accept social-media w/o understand	1.89 (0.95)	2.00 (1.04)	.179	.743	.10
sour_BP — Accept blogs w/o understand	1.88 (0.99)	2.02 (1.00)	.174	.743	.10
sour_VF_RS — Social-media article = true	2.32 (1.10)	2.26 (1.13)	.908	.993	.01
sour_VF_BF — Blog article = true	2.66 (1.06)	2.82 (1.16)	.365	.768	.07

sour_exp_VS_autre — Responder vs my exp.	1.96 (1.04)	2.63 (1.22)	<.001	.003**	.28
sour_cont_RSBP — More certain if aligns w/ RS/BP	3.29 (1.41)	3.15 (1.45)	.445	.768	.06
just_RS_princip — RS knowledge = principles	3.25 (1.16)	2.89 (1.31)	.077	.727	.13
just_RS_cons_exper — RS truth = consensus/experts	2.75 (1.31)	2.96 (1.29)	.240	.743	.09
just_BP_cons_exper — BP truth = consensus/experts	2.79 (1.42)	3.06 (1.30)	.212	.743	.09
just_VF_RS — Means of evaluation RS	2.62 (1.37)	2.73 (1.30)	.578	.915	.04
just_VF_BP — Means of evaluation BP	2.66 (1.35)	2.72 (1.24)	.754	.993	.02

Note. M (SD) on the 1–5 Likert scale; p = two-sided Mann-Whitney U; p (FDR) = Benjamini-Hochberg correction (m = 19); r = |Z|/√N (effect size). **p_FDR < .01.

To complement the item-level analysis, composite scores (mean of items by sub-dimension, after reverse-coding so that higher = more sophisticated) were computed and tested (Table 3). None of the four sub-dimensions shows a significant inter-cycle difference. Effect sizes are small (|d| ≤ .24). The widest gap is on the Source sub-dimension (d = +0.24), not on Justification.

Table 3. Composite scores by sub-dimension: descriptive statistics and inferential tests

Sub-dimension	Primary M (SD)	Secondary M (SD)	t (df)	p (t)	U	p (MW)	d	r
Certainty	3.47 (0.61)	3.51 (0.65)	−0.33 (114.7)	.740	3193	.999	−0.05	.00
Simplicity	2.37 (0.62)	2.43 (0.66)	−0.62 (116.7)	.537	3162	.921	−0.10	.01
Source	3.67 (0.65)	3.52 (0.60)	+1.42 (101.9)	.160	3710	.085	+0.24	.13
Justification	3.00 (0.70)	2.86 (0.54)	+1.26 (88.1)	.210	3498	.309	+0.22	.08
GLOBAL (19 items)	3.24 (0.33)	3.17 (0.33)	+1.18 (109.3)	.242	3664	.117	+0.19	.12

Note. Composite score = mean of recoded items (higher = greater epistemic sophistication). Cohen's d computed with pooled SD. None of the comparisons reaches the .05 threshold.

This dimensional analysis calls for a nuanced reading of the comparative findings. The conclusion is two-fold: the two cohorts converge on 18 of the 19 items and on all four sub-dimensions when tested formally
A single localized difference appears on a Source-of-knowledge item, deference to the online responder when their content conflict with personal experience. Importantly, the inter-cycle difference belongs to the source-of-knowledge dimension and not to the justification-of-knowledge dimension

4.2.3. 4.2.3 Exploratory factor analysis

To understand the moderate α values and to test whether the four-dimensional Hofer-Pintrich structure is recovered empirically on our 19 items, a principal-component analysis (Varimax rotation) was conducted on the combined sample (N = 170). The Kaiser-Meyer-Olkin [23] index is .53 below the conventional .60 threshold for adequacy and Bartlett's test rejects sphericity (χ^2 (171) = 595.22, p < .001). The Kaiser criterion [23] (λ > 1)

suggests seven factors that together account for 61.7 % of the variance, while a forced four-factor solution accounts for only 40.9 %. The seven extracted factors are presented in Table 4 with their interpretations.

Table 4. Seven-factor Varimax rotation: factor labels, items loading, and reading.

Factor	k	Items (highest loadings)	Interpretation
F1 — Evaluation criteria	2	just_VF_RS, just_VF_BP	Awareness of explicit means of evaluating online claims
F2 — Critical questioning	3	cert_RS, cert_BPF, cert_PI	Disposition to question content across the three tools
F3 — Literal truth of online content	3	sour_VF_RS, sour_VF_BF, sour_cont_RSBP	Belief that online content is true and certainty-conferring
F4 — Submission to online responder	2	sour_RS, sour_BP	Accepting answers from RS/BP responders without understanding
F5 — Justification by consensus / principles	3	just_RS_princip, just_RS_cons_exper, just_BP_cons_exper	Reliance on consensus, experts and principles
F6 — Perceived simplicity	3	simp_RS, simp_BP, simp_BE	Perceived ease of comprehension
F7 — Non-contradiction with science	2	cert_contRS, cert_contBP	Belief that online content does not contradict scientific principles

The empirical decomposition is finer than the four Hofer-Pintrich sub-dimensions. The Certainty dimension splits clearly into «critical questioning» (F2) and «non-contradiction with science» (F7); the Source dimension splits into three facets evaluation criteria (F1), literal truth (F3), and submission to the responder (F4); the Justification dimension partly splits between F1 and F5. This finer-grained structure is consistent with recent work on Internet-specific epistemic beliefs [14,15], which has documented that beliefs about online knowledge typically articulate sub-facets that a generic four-dimensional model cannot capture. We treat this factor structure as a working measurement hypothesis to be confirmed on larger and independent samples.

4.2.4. 4.2.4 Demographic effects within the secondary sample

To examine the role of contextual variables, gender (57 F vs 57 H) and discipline of training (sciences and techniques n = 55; human sciences n = 48; economics and management n = 11) were tested as covariates within the secondary sample (Table 5).

Table 5. Effects of gender (Mann-Whitney U) and discipline of training (Kruskal-Wallis H) on the four sub-dimensions and the global score, secondary sample (N = 114).

Dimension	M (F)	M (M)	U	p	d	H (Discipline)	p	η²
Certainty	3.47	3.54	1586.5	.831	−0.11	3.42	.181	.013
Simplicity	2.36	2.50	1390.0	.179	−0.21	0.41	.816	—
Source	3.49	3.55	1489.5	.444	−0.11	0.62	.732	—
Justification	2.81	2.92	1433.0	.276	−0.20	4.35	.114	.021
GLOBAL	3.13	3.22	1393.0	.190	−0.28	7.03	.030*	.045

Note. *p < .05. Discipline of training: sciences and techniques (n = 55), human sciences (n = 48), economics and management (n = 11).

Gender has no detectable effect on any of the four sub-dimensions, despite balanced numbers (57 vs 57). Discipline of training has a small but significant effect on the global epistemological score ($H = 7.03$, $p = .030$, $\eta^2 = .045$) but does not survive correction on individual sub-dimensions. This pattern is consistent with the hypothesis of differentiated epistemic autonomy by disciplinary affiliation [11] and suggests that the discipline trained in is a more relevant contextual variable than gender for the kinds of beliefs at stake here.

5. DISCUSSION

5.1. A cross-cycle convergence that is itself a finding

The dominant pattern is convergence: on 18 of the 19 items, prospective primary and prospective secondary teachers do not differ significantly. The four sub-dimensional composite scores yield small, non-significant effect sizes ($|d| \leq .24$). At first reading this could be taken as a null result, but in light of the literature it is in fact substantive. [16] showed, on the basis of a longitudinal study of prospective teachers, that epistemic beliefs change slowly during initial training. From this perspective, the absence of a marked inter-cycle differentiation at the CRMEF Meknes is consistent with the prediction that a one-to-two-year training program, however differentiated by cycle of destination does not produce sharply contrasted epistemic profiles. The originality of the present study is thus to extend this prediction to the Moroccan context and to a specifically digital-tools instrument.

5.2. A localized difference on deference to the online responder

Against this background of convergence, the single robust difference on sour_exp_VS_autre is informative precisely because it stands out. Prospective secondary teachers more readily endorse the idea that, when one's own experience conflicts with what an online responder asserts, the responder is probably right ($M = 2.63$ vs $M = 1.96$; $r = .28$). Two complementary interpretations can be advanced. The first, in line with [11], is that disciplinary specialization in the secondary cycle, especially in domains where canonical written sources play a strong role ,fosters a stance of greater deference to external textual authority. The second, more cautious, interpretation is that this item taps a Source-of-knowledge facet (factor F4 in our EFA: Submission to the online responder») and that what is observed is not a generalized authority bias but a specific behavior pattern with respect to online responders. Either way, the inter-cycle difference is on Source-of-knowledge and not on Justification-of-knowledge.

5.3. The instrument: from a single «sophistication» score to a finer measurement model

The reliability and factor-analytic findings converge on a single methodological message. The instrument, in its current 19-item form, is exploration: it does not reach the conventional α threshold for an aggregated score, three items behave heterogeneously with the rest of the scale, and the empirical factor structure differs from the four-dimension theoretical model.

Rather than relying on an aggregated “sophistication” score, the present study treats the four canonical sub-dimensions as theoretical anchors and the seven empirical facets as a working measurement hypothesis. This is consistent with recent psychometric work on Internet-specific epistemic beliefs [14,15] and with the broader observation, established since [13], that the appropriate level of analysis for personal epistemology is not necessarily a single global score.

5.4. Demographic findings: discipline matters more than gender

Within the secondary cohort, gender does not predict epistemic beliefs at the item, sub-dimension or global level. Discipline of training, by contrast, has a small but statistically significant effect on the global score. The descriptive trend with sciences-and-techniques and human-sciences trainees showing slightly different profiles than economics-and-management trainees , should be replicated on a larger sample with balanced cell sizes before being interpreted theoretically. The result is reported here primarily to acknowledge that contextual variables matter and that the design of subsequent studies should sample disciplines explicitly.

6. Conclusion

This study examined the comparaison of prospective primary and prospective secondary teachers' epistemological beliefs about three digital tools : social networks, trainers' personal blogs and institutional portals , at the CRMEF Meknes. With inferential testing in place of pure descriptive frequencies, three findings emerge.

First, the two cohorts converge on 18 of the 19 common items and on all four sub-dimensions; this convergence is consistent with the slow change of epistemic beliefs during initial training documented by [16] and constitutes the principal substantive result. Second, a single, localized difference on deference to the online responder when their content conflicts with personal experience, distinguishes the two cycles, with prospective secondary teachers showing greater deference ($r = .28$). The difference belongs to the Source-of-knowledge dimension, and not to the Justification-of-knowledge dimension. Third, the four-dimensional Hofer-Pintrich structure decomposes empirically into seven

finer facets when applied to specifically digital tools in this Moroccan context, in line with the literature on Internet-specific epistemic beliefs [14,15].

The implications for teacher training are oriented toward, on the one hand, helping prospective secondary teachers articulate their relation to online authority and in particular to the «responder» as a figure of digital expertise and, on the other hand, refining the measurement instrument so that the four canonical dimensions and the seven empirically attested facets can be tracked across cycles and across regional centers. These results demonstrate the gain that comes from combining inferential testing with transparent reliability reporting: the comparative picture is both more cautious and more precise than a purely descriptive analysis would have allowed, and instrument reliability emerges as a substantive target of inquiry rather than a background assumption.

Limitations and directions for future research

Five limitations bear emphasis. First, both samples are drawn from a single regional center (CRMEF Meknes), and the present findings should not be generalized to other regional centers or to the population of Moroccan prospective teachers as a whole without replication. The single-site design is a strength in that it neutralizes institutional confounds between cycles, but it is also a constraint on external validity. Second, sample sizes are moderate (N = 56; N = 114) and the sex-ratio of the primary sample is unbalanced; both features limit the statistical power to detect small effects. Third, the instrument does not reach the conventional reliability threshold for an aggregated score; we present the analyses at the item level and as sub-dimension composites, and we treat the seven-factor structure as exploratory. Fourth, the data are self-reported and cross-sectional. The Moroccan context lacks longitudinal designs that would track how epistemic beliefs evolve during training; such designs together with mixed-methods studies that triangulate self-reports with observation of actual digital practices are a priority for future work. Fifth, the present study deliberately narrows the construct to beliefs about three digital-tool families; an extension to a broader notion of digital culture (in the sense of [3]) requires articulating practices and beliefs in the same design.

Three avenues for future research follow directly. (i) A multi-site replication across several CRMEFs would test the robustness of the cross-cycle convergence reported here. (ii) A confirmatory factor analysis on an independent sample, using rewritten items to reduce the reverse-coding heterogeneity, would allow the seven-facet model to be tested formally. (iii) A targeted investigation of the deference-to-the-online-responder finding, possibly using vignette studies, would clarify whether the inter-cycle difference reflects a generalized authority bias or a specific facet of source-of-knowledge beliefs.

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