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Scientific Reconstruction of Sasak Pelemeng Preparation for Contextual Chemistry Learning

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Abstract

Traditional food practices can provide culturally situated contexts for chemistry learning, but a documented preparation sequence does not by itself establish food-specific chemical mechanisms or teaching effectiveness. This study develops a preliminary, literature-supported conceptual learning map from one existing field report documenting one experienced Pelemeng practitioner in Merce Hamlet, Lombok, on 23 October 2026. Using secondary qualitative analysis, the reported stages and photographs were coded as empirical records (E), literature-supported scientific explanations (S), or untested product-specific propositions (U). The reported formulation contained 1 kg of glutinous rice, 400 mL of coconut milk, and an imprecisely recorded salt quantity; cooking lasted approximately two hours in the interview and two to three hours in the procedure. The evidence map connects rice soaking with hydration, salt addition with ionic dissolution, coconut milk with oil-in-water emulsion structure, and wet heating with expected starch gelatinization. It also identifies unresolved uncertainties regarding coconut-milk addition, wrapper permeability, starch–lipid complexation, and retrogradation. Four proposed guided-inquiry activities specify measurable variables and assessable explanations for upper-secondary chemistry or introductory science education. These activities have not been classroom-tested. The main contribution is a transparent translation from one culturally specific process record into differentiated scientific claims, uncertainties, and testable teaching questions, rather than chemical characterization or evidence of improved learning.

Keywords: ethnoscience; glutinous rice; coconut milk; gelatinization; chemistry education

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INTRODUCTION

Traditional foods hold knowledge about botanical resources, processing sequences, material selection, and socially transmitted techniques. The wider ethnobotanical literature documents the importance of food preparation for cultural continuity and for sustaining place-based knowledge across generations (Aziz, 2023; Bultosa et al., 2020; Lalmuanpuii et al., 2021; Sukenti et al., 2016). Studies in other communities additionally show that traditional food practices respond to changing environments, social networks, and access to resources; these comparisons support studying local practice without presuming that one regional recipe represents an entire culture (Abbas et al., 2016; Abdullah et al., 2021; Alalwan et al., 2017; Chukwu

& Dogbe, 2023). For this case, ethnobotanical literature provides cultural context; the specific chemistry-education gap concerns how to translate incomplete procedural records into scientific explanations without overstating what the practitioner or photographs establish.

The Sasak community of Lombok maintains diverse preparations that draw on cultivated plant materials and household expertise. A wider ethnobotanical survey of Sasak cuisine identified substantial diversity of plant-based foods and positioned coconut as an especially important ingredient (Sukenti et al., 2016). Ethnobotanical studies elsewhere similarly caution that the identification, conservation, and transmission of food plants depend on cultural context and cannot be inferred from ingredient lists alone (Alrhmoun et al., 2025; Luo et al., 2024; Nko et al., 2026). Pelemeng, a glutinous-rice preparation enclosed within banana-leaf cylinders, offers a particularly tangible context for tracing material transformations through preparation and cooking. Pelemeng is analytically distinctive because soaked glutinous rice, a coconut-milk emulsion, salt, and a sealed leaf cylinder interact across a single ordered heating process. The uncertainty about whether coconut milk is mixed before filling or poured into the wrapper matters scientifically: different initial distributions could yield different hydration and heating trajectories, although this effect remains untested.

Science education researchers increasingly advocate connecting scientific representations with learners' lived experience, including indigenous knowledge and local technological practice. Contextual collaborative ethnoscience instruction has been studied in Indonesian chemistry education, while broader studies report opportunities for developing scientific literacy, cultural literacy, and higher-order reasoning (Atmojo et al., 2025; Dewi et al., 2021; Yuliana et al., 2021). Nevertheless, a systematic review of indigenous knowledge integration emphasizes the importance of sound pedagogy and an explicit relationship between cultural knowledge and scientific explanations (Ogegbo & Ramnarain, 2024). The present reconstruction treats the practitioner's decisions about ingredient sequence, leaf wilting, and containment as situated practical knowledge in their own right; scientific models are interpretative companions, not replacements for the cultural account. The proposed audience is upper-secondary chemistry learners, adaptable to introductory science education, with priority on the distinction between observations, explanatory models, and claims needing measurement.

Practical food technologies provide useful entry points for molecular reasoning. Glutinous rice contains starch dominated by amylopectin, whose molecular organization shapes cooking behavior; soaking changes water uptake, whereas subsequent heating in sufficient water can produce gelatinization rather than stoichiometric hydrolysis (Bello et al., 2004; Shoukat et al., 2025). Coconut milk is a dispersed oil-in-water emulsion whose proteins contribute to interfacial stability, and its interactions with rice during heating offer a basis for discussing mixtures, colloids, and the structure–property relationship (Onsaard et al., 2005; Patil & Benjakul, 2018; Tangsuphoom & Coupland, 2005). However, a laboratory mechanism applicable to an

ingredient must not automatically be claimed as an analytical result for the particular food reported here.

Lombok-focused learning studies have mapped local wisdom to science teaching, and other Indonesian work has extracted chemical ideas from traditional processes such as *Medaq Api* and batik production (Andayani et al., 2022; Hikmawati et al., 2021; Solikah et al., 2026). More recent inquiry-, project-, and technology-supported ethnoscience studies offer instructional precedents, but such evaluations do not establish the classroom effectiveness of Pelemeng without direct implementation (Fitria et al., 2025; Harjono et al., 2025; Nurhasnah et al., 2026; Prayogi et al., 2023; Verawati et al., 2025). The present work extends that literature by connecting one documented Pelemeng production sequence to explicitly delimited chemistry mechanisms and observable inquiry variables. Comparatively, Hikmawati et al. (2021) surveyed Lombok local-wisdom contexts for science learning, Andayani et al. (2022) identified chemical concepts in the Medaq Api practice, and Solikah et al. (2026) examined scientific elements of batik-making. Those contexts and analytical aims differ from the present secondary reconstruction of a single food-production record; none of those cited studies validates the Pelemeng formulation or its proposed learning activities. The unmet need addressed here is not another list of culturally relevant chemical topics, but an explicit link between the provenance of each process claim, its permissible scientific interpretation, and a testable instructional question.

This study asks which Pelemeng preparation actions are documented in the existing report, how those actions can be associated with established chemical principles, and which plausible mechanisms remain untested in the actual food. Its contribution is an auditable, case-specific conceptual learning map that makes contradictory procedural descriptions analytically visible and links each interpretation to a proposed observation or classroom test. The E/S/U labels provide a transparent decision procedure rather than independent evidence of novelty or inter-rater reliability. No hypothesis about student achievement is tested; for future inquiry, the working expectation is that controlled measurements can discriminate process-dependent explanations from assumptions (Andrada et al., 2025; Dewi et al., 2020; Suwono et al., 2026).

METHOD

Research design, participant, and empirical material

This study is a secondary qualitative analysis of an existing 12-page field report, finalized after an interview and process photography on 23 October 2026 in Merce Hamlet, Selat Village, Narmada District, Lombok, Indonesia (Azizah & Sari, 2026). The source describes one 50-year-old practitioner, Ayani, with approximately 33 years of preparation experience and family-based transmission of the method. This information-rich case is sufficient to examine what one report documents and to generate case-specific conceptual interpretations; it is not a purposive sample supporting claims about the wider Sasak population. The report was attributed to Azizah and Sari, who are also named among the manuscript authors; the present analysis should not be represented as a new independent interview. Selection criteria

beyond the practitioner's experience, interview duration, audio/video recording, question guide, and the original sampling rationale are not reported in the supplied corpus and therefore cannot be reconstructed. No student data, chemical assays, controlled temperature traces, or microbiological testing were available.

Evidence coding and chemistry reconstruction

The analytical unit was each documented action: washing and soaking; coconut extraction and salt addition; banana-leaf wilting and cylindrical shaping; filling; boiling; and cooling or serving. E was assigned only when an action or quantity was stated in the report or visibly shown in the field photographs; photographs confirmed visible materials and stages, never molecular mechanisms. S was assigned to a scientifically established, ingredient-level mechanism supported by relevant food-chemistry or physical-science literature, without claiming that it was measured in this Pelemeng sample. U was assigned to any sample-specific mechanism, numerical property, causal effect, or procedural reconciliation lacking direct observations or measurements. For example, 'rice soaked for at least two hours' is E; hydration during soaking is S; the precise water diffusion coefficient is U. Source selection prioritized studies directly addressing rice hydration, starch transitions, coconut emulsions, thermal physics, and ethnoscience pedagogy, supplemented by relevant reviews and local reconstruction studies. This is a targeted narrative comparison, not a systematic literature review. The report does not document an independent second coder, adjudication meeting, or inter-rater statistics; consequently, the coding should be understood as an explicit author interpretation open to independent replication, not as validated coding reliability.

Figure 1 represents the evidence-extraction and classification pathway. Each process statement was checked against its source (interview narrative, procedural description, or photograph); apparent inconsistencies were retained as separate E records. Literature was then used to establish candidate S explanations, while product-specific claims not observed or measured were assigned U. An instructor-facing task was retained only if it specified a manipulable or observed variable, a control, and a plausible assessment indicator. These decisions distinguish the reconstruction from food composition analysis or intervention evaluation (Andayani et al., 2022; Ogegbo & Ramnarain, 2024; Solikah et al., 2026).

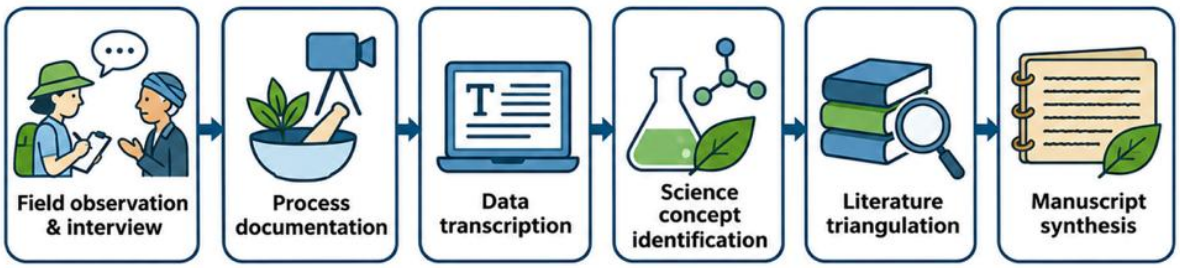


Figure 1. Evidence-extraction, E/S/U coding, literature triangulation, uncertainty classification, and proposed task-design workflow; the original field record remains the source of E claims.

Research integrity and interpretative limits

The interview supplies one practitioner's knowledge, not a representative regional sample. It reports approximately two hours of cooking in the interview but two to three hours in the procedural description; the latter is presented as a documented range without claiming instrumental validation. The procedure also discusses mixing coconut milk with raw rice or partially precooking it, while later steps depict pouring coconut milk into a filled banana-leaf casing; these alternatives were preserved as reported procedural options. Temperature, wrapper dimensions, salt mass, rice amylose content, water absorption, and food-microbiology results were absent. No identities or consent were inferred beyond the material supplied. The supplied materials do not establish whether written informed consent, permission to reuse photographs in a journal article, or institutional ethics review was documented. Publication should therefore be conditional on verification of the applicable permissions, particularly for identifiable content. In the absence of independent records, the manuscript does not claim an ethics approval number or consent procedure.

RESULTS AND DISCUSSION

The documented Pelemeng preparation sequence

Figure 2 presents six process photographs from the source field report. Panels (a) and (b) show rice and coconut-milk handling; (c) shows a leaf cylinder; (d) shows the cooking apparatus; (e) shows wrapped food after heating; and (f) shows serving. These images support the visible materials and stages only. They do not independently verify quantities, exact durations, the order of coconut-milk addition, temperatures, or the presence of a chemical transformation. The corresponding verbal process descriptions are therefore reported separately from photo-supported observations.



Figure 2. Original field photographs of Pelemeng preparation: (a) glutinous rice, (b) coconut milk extraction and handling, (c) banana-leaf cylinder, (d) boiling over a wood fire, (e) cooked wrapped product, and (f) serving. Source: final field research report, 2026. Subfigure labels are centered below the corresponding images.

The source records 1 kg of glutinous rice and 400 mL of coconut milk, equivalent to a formulation ratio of 0.40 mL per gram of initial dry rice, not a final moisture concentration (Azizah & Sari, 2026). Salt is described as 'half a spoon' in the ingredient table but 'half a tablespoon' in the interview narrative; these non-equivalent descriptions cannot be converted to mass or molarity. Rice washing and soaking for at least two hours, wilting and folding the banana leaf, cooking, and cooling are documented process stages. The interview describes approximately two hours of cooking, whereas the written procedure states two to three hours. Neither account provides a temperature trace, replicated duration, or an instrument-based measurement. This variability limits transfer of the recipe as a fixed experimental protocol.

Table 1. Integrated field evidence map: source-level observations, scientific interpretations, unresolved uncertainty, and potential instructional uses.

Field stage	Documented source evidence (E) and provenance	Scientific status, uncertainty and proposed use
Raw materials	1 kg rice; 400 mL coconut milk; salt '½ spoon' in ingredient table / '½ tablespoon' in narrative (report)	Rice starch and milk emulsion (S); precise salt dose (U). Use: compare mass/volume reporting.
Soaking	Washing and ≥2 h soaking (interview/procedure); rice visible in Fig. 2a	Hydration (S); grain-specific uptake (U). Use: mass-gain series.
Milk and salt	Coconut handled in Fig. 2b; salt addition described in report	O/W emulsion and ionic dissociation (S); actual emulsion change (U). Use: controlled creaming test.
Wrapping	Leaf cylinder visible in Fig. 2c; wilting and pinning described	Pliability explanation (S); permeability/barrier efficacy (U). Use: folding or leakage comparison.
Filling	Mix-before-filling vs pour-after-filling both described; photographs do not decide route	Distribution effect (U). Use: compare route with matched rice and milk.
Cooking	Wood-fired cooking visible in Fig. 2d; ~2 h interview, 2–3 h procedure	Expected wet-heat gelatinization (S); actual thermal profile (U). Use: core-temperature time series.
Cooling	Cooked product/serving visible in Fig. 2e–f; cooling verbally described	Retrogradation/texture change (U). Use: time-controlled texture comparison.

Two coconut-milk addition sequences are recorded within the written field procedure: mixing salted milk with the rice before enclosure (with a possible partial precooking variant), and pouring milk over rice already placed in the leaf cylinder.

The supplied evidence does not attribute each option to a particular photographed batch, establish whether they occurred in different preparations, or resolve which route the practitioner most frequently used. This source-level ambiguity is an empirical finding of the reconstruction, not an experimental comparison. Because liquid distribution could affect hydration, lipid contact, and warming, a replicable follow-up must first document and reproduce each route before testing mechanistic effects.

Water absorption and salt dissolution

Rice soaking is best interpreted initially as hydration and transport within the grain rather than as enzymatic conversion of starch to glucose. Water uptake depends on rice structure, temperature, and time; Bello and colleagues quantified this process in rice using effective diffusion models (Bello et al., 2004). The simplest field-to-laboratory measure is mass gain after standardized draining: water-uptake index (%) = $100 \times (m_t - m_0) / m_0$, where m_0 is the initial dry grain mass and m_t is the mass after a specified soaking interval. In a diffusion model, the flux is $J = -D_{eff}(\partial C/\partial x)$, but D_{eff} cannot be estimated from a single reported soaking duration. For a feasible upper-secondary investigation, students could keep water temperature constant (for example, a measured room-temperature bath), use equal initial rice masses, measure at 0, 30, 60, 90 and 120 minutes, drain each sample through the same sieve for a fixed interval, gently blot surface water with the same procedure, and perform at least three independent replicates per time point. The measured response is percentage mass gain; the proposed protocol is instructional, not a procedure performed in the field study.

Dissolving kitchen salt in the aqueous phase of coconut milk is described by $NaCl(s) \rightarrow Na^+(aq) + Cl^-(aq)$. This is ionic dissociation during dissolution, not a new compound-forming reaction. The recipe's 'half spoon' measure does not allow a defensible molarity calculation, because neither salt mass nor the free-water fraction of the coconut milk was measured. Ionic strength could nonetheless be examined in a teaching experiment because salt and pH are known to influence coconut-milk protein solubility and emulsion behavior (Onsaard et al., 2005; Tangsuphoom & Coupland, 2008). The sodium and chloride ions are a chemical explanation for salt dissolving in the aqueous portion of the milk, whereas any change in emulsion stability from this particular salt dose remains U. Students could compare equal-volume coconut-milk samples with weighed added salt while controlling temperature and mixing, but no direction or magnitude of change can be predicted for the field batch.

Starch microstructure and heat-mediated gelatinization

Glutinous rice is commonly amylopectin-dominant, although the starch composition of the actual grain in this report was not assayed (Shoukat et al., 2025; Yu et al., 2014). This compositional background provides a basis for discussing a possible cohesive cooked texture, not a measured molecular profile of Pelemeng. Detailed α-(1→4) and α-(1→6) bonding can be introduced in advanced classes but is not required to establish the source-to-concept relationship.

During soaking, water penetrates the grain but limited cold-water hydration should not be equated with full gelatinization. During subsequent wet heating, starch granules may swell and lose semicrystalline order, producing substantial changes in cohesiveness and bite. The pedagogical transformation may be written as 'starch granules + water + heat → hydrated, gelatinized starch', which is a physical-structural process representation, not a balanced chemical equation. Figure 3 isolates that single concept for the corresponding discussion (Shoukat et al., 2025). Gelatinization is therefore an expected mechanism under sufficient wet-heating conditions, not a finding confirmed by thermal analysis or microscopy in this case. The conceptual arrow in Figure 3 is an instructional representation, not stoichiometry or experimental proof.

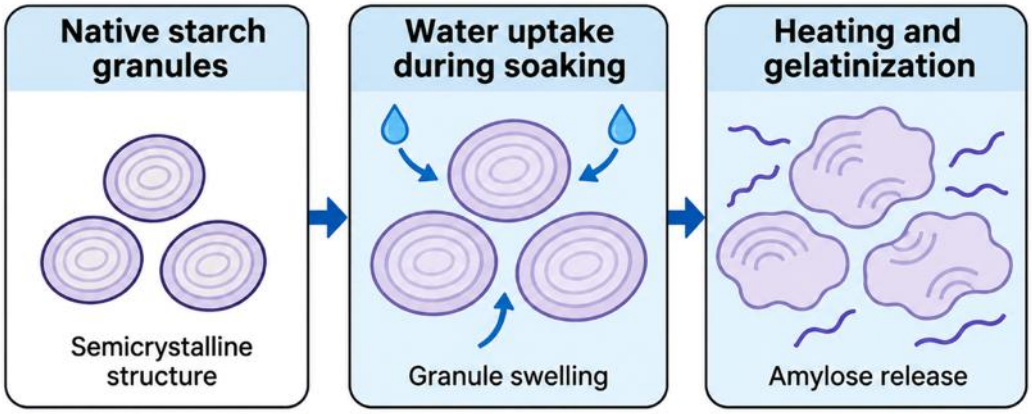


Figure 3. Schematic transformation of native starch granules during hydration and heating; conceptual model, not a micrograph of the local rice sample.

Starch hydrolysis, represented ideally by $(C_6H_{10}O_5)_n + nH_2O \rightarrow nC_6H_{12}O_6$, would require suitable catalytic or reaction conditions and was not demonstrated during Pelemeng boiling. This distinction makes the case useful for correcting the misconception that heating any starchy food necessarily converts its polymer into simple sugars. After cooking, cooling can enable molecular reassociation and altered texture; reviews of rice-based systems discuss retrogradation and the moderating effects of other macromolecules (Nie et al., 2026; Scott & Awika, 2023). In this field study, the degree of retrogradation remains an interpretation requiring texture analysis, DSC, or diffraction evidence. Hydration concerns water uptake; gelatinization concerns the disruption of starch-granule order during heating; hydrolysis involves cleavage of glycosidic bonds; and retrogradation denotes molecular reassociation during cooling or storage. None should be treated as interchangeable or assigned sample-specific quantitative values without the relevant measurements.

Coconut milk as an oil-in-water emulsion

Coconut milk derives from the solid endosperm of *Cocos nucifera*. It consists of dispersed lipid droplets within a continuous aqueous phase, stabilized in part by interfacial proteins and other amphiphilic constituents (Onsaard et al., 2005; Patil & Benjakul, 2018). This makes it particularly relevant for teaching why a cloudy food liquid can be a colloidal emulsion rather than a molecularly homogeneous solution.

Figure 4 represents the essential interface concept without asserting measured droplet dimensions in the field sample.

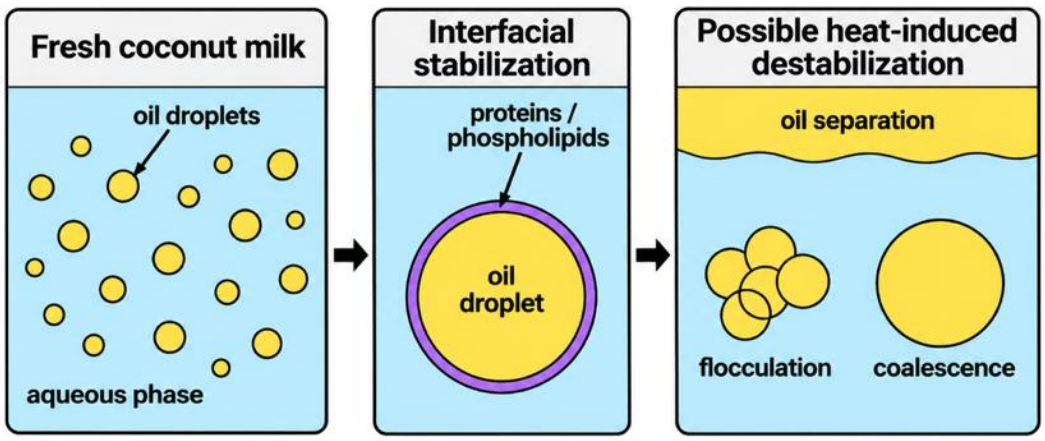


Figure 4. Oil-in-water structure of coconut milk and one possible heat-induced aggregation response; neither droplet size nor emulsion instability was measured in the reported Pelemeng.

Heating, agitation, ionic strength, and protein state can alter emulsion stability. Experimental studies of coconut milk have reported heat-related flocculation, changes in creaming, and different responses to pH or salt levels (Tangsuphoom & Coupland, 2005; Tangsuphoom & Coupland, 2008). These findings identify plausible variables for a controlled investigation but do not prove that a visible phase separation occurred inside the tightly wrapped Pelemeng. The scientific status of 'emulsion destabilization in the actual food' is consequently U rather than E in the evidence scheme. Importantly, Onsaard et al. (2005) and Tangsuphoom and Coupland (2005, 2008) report ingredient-level experimental behavior under their study conditions; their findings support scientific plausibility (S), but not empirical confirmation (E) of separation or droplet aggregation inside the wrapped Pelemeng.

An additional conceptual issue concerns lipid–starch interactions. Amylose can form helical inclusion complexes with certain lipids under suitable conditions, and rice starch studies have examined such complexes experimentally (Tamura et al., 2025). Yet coconut milk contains most of its fatty acids as triacylglycerols, and glutinous rice is low in amylose. Thus, complex formation in this recipe cannot be asserted from the ingredient list alone; any claim would require matched control samples and appropriate physicochemical analysis.

Table 2. E/S/U status of each proposed chemical mechanism and its effect on allowable product-specific claims.

Concept	Evidence available	Limitation for this Pelemeng sample
Starch-rich rice	E: grain identity; S: generic starch structure; U: actual amylose profile	No amylose fraction or starch thermal profile

Concept	Evidence available	Limitation for this Pelemeng sample
Coconut milk emulsion	E: milk use; S: O/W ingredient-level structure; U: in-product destabilization	No droplet-size or phase-stability data
Salt dissociation	E: salt added; S: ionic dissociation; U: actual molarity or emulsion response	No quantitative NaCl concentration
Gelatinization	E: wet heating; S: expected gelatinization; U: confirmed gelatinization of sample	No DSC or microscopy
Retrogradation	E: cooling; S: plausible starch reassociation; U: actual retrogradation	No time-dependent crystallinity or texture series
Starch–lipid complexes	E: coexistence of rice and lipids; S: possible in other foods; U: complex formation here	Not demonstrated for low-amylose rice or local recipe

Banana leaf casing, heat transfer, and biological materials

Banana leaves are a plant-based wrapping material with epidermal surfaces, a cuticle, mesophyll, vascular bundles, and structural cell-wall polymers. Botanical classifications support use of *Oryza sativa* for rice and *Cocos nucifera* for coconut, while the leaf in the report is identifiable only as *Musa* spp. without a voucher specimen or cultivar description (Royal Botanic Gardens, Kew, 2026; Skutch, 1927). Wilting plausibly changes pliability by modifying tissue hydration and turgor, but its contribution to measured tensile or folding strength has not been assessed for the local sample. The banana-leaf casing is documented as a physical enclosure (E), whereas describing it as a quantified transport barrier is a hypothesis (U): permeability, thickness, and leakage were not measured. The practitioner's decision to wilt and pin the leaf is therefore preserved as a material-handling technique rather than recast as a proven barrier mechanism.

The elongated tubular package presents an instructive heat-transfer geometry. An ideal-cylinder volume can be approximated by $V = \pi R^2 L$, while the heat-transfer response depends on the material's effective conductivity, density, and heat capacity. During boiling, convection supplies energy to the wrapper surface and conduction transfers heat toward the center, which may be described by $\dot{q} = hA(T_{fluid} - T_{surface})$ and Fourier's law $\dot{q} = -kA(dT/dx)$. These equations are explanatory models; R, L, h, k, and the interior temperature profile were not measured. Reference values for water properties should be drawn from standard thermodynamic tables rather than attributed to the interview (Harvey, 1998). A simple classroom extension could heat equal volumes of water in comparable leaf-wrapped cylinders of measured

radii and record center temperature with a food-safe probe at fixed intervals, keeping initial temperature, immersion depth, heating vessel, and length constant. Without a probe, students may discuss qualitative warming but must not fit a conductivity coefficient. The cited transfer equations are schematic physical models, not values derivable from this report.

The locally learned method of forming and pinning the wrapper can accordingly support inquiry into force, bending, heat flux, diffusion, and the difference between a measured variable and an assumed one. The biological origin of the ingredients additionally permits discussion of rice caryopsis endosperm and coconut endosperm as storage tissues, while avoiding unsupported cultivar-level identifications (Royal Botanic Gardens, Kew, 2026; Yu et al., 2014).

Cultural knowledge transmission and comparison with previous work

The interviewee reported learning preparation from her parents and maintaining the skill for approximately 33 years. This agrees with a broader picture in which food knowledge is maintained through family practice, intergenerational observation, and locally appropriate materials (Aziz, 2023; Lalmuanpuii et al., 2021; Sukenti et al., 2016). Comparative ethnobiological studies also emphasize the vulnerabilities of food heritage to rapid social change and the value of carefully recorded, community-situated knowledge (Alrhmoun et al., 2025; Chukwu & Dogbe, 2023; Luo et al., 2024). The choice to wilt the leaf, form a sealed cylinder, and adjust the placement of coconut milk represents locally transmitted practical reasoning about pliability, handling, and production sequence. Recording these actions preserves knowledge that a purely chemistry-centered explanation would otherwise omit.

Research outside Lombok reinforces the importance of avoiding an extractive view in which tradition is treated only as a source of scientific examples. Studies of plant foods in Botswana, Bahrain, South Africa, and the Hindukush show that processing knowledge is situated within social, ecological, and cultural systems (Abbas et al., 2016; Abdullah et al., 2021; Alalwan et al., 2017; Bultosa et al., 2020; Nko et al., 2026). By describing whose practice was recorded and what cannot be generalized from one interview, the present study preserves the distinction between a culturally valid report and a representative survey of Sasak households. Where prior studies document different cultural and material contexts, this case supplies a specific methodological lesson: when process narratives conflict, preserving their provenance is scientifically more defensible than merging them into a single idealized recipe.

Instructional translation and limits of educational inference

Table 3 proposes four guided-inquiry tasks derived from the documented stages and associated S/U classifications. The independent and dependent variables, controls, simpler and advanced equipment options, and expected indicators make the tasks assessable as design proposals. Students should distinguish a reported action from a measured result, label a chemical explanation as a model, and justify whether the available data support a conclusion. The tasks target conceptual understanding and evidence-based reasoning; their effects on learning have not been assessed

(Atmojo et al., 2025; Dewi et al., 2020; Dewi et al., 2021; Harjono et al., 2025; Kurniawan & Basuki, 2024).

Table 3. Proposed Pelemeng inquiry activities: variables, controls, equipment options, observations, and assessment indicators (not classroom-validated).

Inquiry question	Measurements or controls	Assessment target
How does soaking time affect water uptake?	IV: soaking time (0, 30, 60, 90, 120 min); DV: blotted grain mass gain. Controls: rice mass, bath temperature, drain/blot method; ≥3 replicates. Simple: sieve/balance; advanced: temperature-controlled bath.	Plot uptake (%) over time; explain hydration vs dissolution; assess units and replication.
What makes coconut milk an emulsion?	IV: controlled heating or weighed salt addition; DV: visible cream layer/creaming index. Controls: milk batch, volume, mixing, time. Simple: marked tubes/camera; advanced: microscopy.	Identify dispersed/continuous phases, distinguish observed separation from predicted mechanisms.
How does wrapper radius affect warming?	IV: wrapper radius; DV: center temperature over time. Controls: cylinder length, starting temperature, bath depth. Simple: insulated mock cylinders and thermometer; advanced: data-logging probe.	Compare warming curves; explain convection vs conduction, avoid estimating unknown k.
Why does cooked rice become cohesive?	IV: cooling time after matched cooking; DV: standardized qualitative firmness or texture. Controls: rice batch, masses, cooking. Simple: observation/consistent indentation; advanced: texture analyzer/DSC.	Separate gelatinization from proposed retrogradation; justify claims from actual measurements.

Broader studies of ethnoscience materials, digital inquiry, citizen science, and contextual projects provide useful design precedents (Fitria et al., 2025; Nurhasnah et al., 2026; Prayogi et al., 2023; Suwono et al., 2026; Verawati et al., 2025; Yuliana et al.,

2021). Local-wisdom inquiry on Lombok and investigations of other Indigenous food systems likewise suggest value in combining cultural specificity with explicit measurement and critical comparison (Andayani et al., 2022; Andrada et al., 2025; Hikmawati et al., 2021). However, no learners were recruited and no pre/post assessment, concept inventory, or instructional fidelity evaluation was conducted in the present study. Any learning-effectiveness claim must await classroom trials with valid instruments. Relevant reviews of Ethno-STEM project-based learning describe implementation trends, rather than testing this Pelemeng unit (Nirmala et al., 2025). Structured reflection has also been argued to strengthen the quality of inquiry-based reasoning, but that commentary is not direct outcome evidence for this resource (Verawati, Wahyudi, & Nisrina, 2025). Possible assessment indicators include accurate separation of E/S/U claims, appropriate use of graphs and units, explanation of controlled comparisons, and explicit recognition of alternative process routes. The assessment framework can also draw on higher-order reasoning constructs discussed in Muhali et al. (2026), without assuming this case achieves those outcomes.

The reconstructed learning tasks also support food literacy and responsible treatment of ethnobotanical resources, perspectives addressed in recent food-literacy and traditional-food studies (Aisyah et al., 2026; Aziz, 2023; Chukwu & Dogbe, 2023). For cooked rice products, food-safety guidance highlights the relevance of handling and storage to the risk of *Bacillus cereus*. The interview reports cooling before slicing, but does not establish a safe storage duration, a cooling temperature, or microbiological quality (Food Standards Australia New Zealand, n.d.). The educational activity should therefore not use tasting of improperly held rice as an assessment method. Classroom observation or supervised cooking should be distinguished from tasting and storage: any tasting requires an independently established safe preparation and handling protocol. No microbial test in this study establishes that the reported product or cooling practice is safe.

CONCLUSION

This secondary reconstruction produces a preliminary, case-specific conceptual learning map grounded in one practitioner's reported Pelemeng preparation and existing process photographs. Its distinctive scholarly contribution is the explicit trace from each cultural process record to a literature-supported explanation, an unresolved product-specific claim, and a potentially testable learning task. The salt-unit discrepancy, two cooking-duration accounts, and alternative coconut-milk addition routes are retained as consequential uncertainties rather than suppressed. Hydration, dissolution, coconut-milk emulsion structure, and expected gelatinization are defensible conceptual links; retrogradation, starch–lipid complexation, wrapper transport properties, and learning outcomes have not been demonstrated in this sample. The map has not undergone independent coding-reliability, laboratory, or classroom validation.

RECOMMENDATION

The immediate usable output is a transparent source-to-concept map and four proposed inquiry protocols, not a tested teaching model. First, the original researchers

should verify the consent and photograph-reuse record, clarify salt measurement and coconut-milk addition routes, and document the actual heating and cooling sequence. Second, replicated preparations should record ingredient masses, soaking and boiling conditions, wrapper dimensions, center temperatures, and texture, while ensuring safe handling. Only after these basic uncertainties are resolved should more specialized emulsion, differential scanning calorimetry, diffraction, or starch–lipid assays be considered. A later classroom study may assess conceptual explanation and evidence-based reasoning with validated rubrics and appropriate comparison groups (Ogegbo & Ramnarain, 2024; Solikah et al., 2026; Suwono et al., 2026).

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