Handbook: Empowering PME with AI - Sessions 2 & 3: Prototyping, Implementing, and Sustaining AI

Introduction to Handbook 2

Welcome to the second installment of your workshop handbook for "Empowering PME with AI: A Practical Path Through Uncertainty." We hope Session 1 provided a solid foundation and sparked new ideas for how AI can enhance your PME curriculum. This handbook builds directly on those initial concepts, guiding you through the practical steps of prototyping, implementing, and sustaining AI-enhanced learning experiences.

Building on Session 1

In our first session, we established the strategic context for AI in PME, demystified key AI concepts, and explored the ethical landscape. Your intersession homework, the Curriculum Analysis and Opportunity Mapping, was crucial in helping you identify specific areas within your own courses where AI could make a difference. This handbook will now equip you with the 'how-to' knowledge to bring those ideas to life.

Navigating This Handbook

This handbook is designed to support your learning for both Session 2 and Session 3. Chapters 1 through 3 align with the content of Session 2, focusing on rapid prototyping and GAI-partnered design. Chapter 4 details your second intersession assignment. Chapters 5 and 6 cover the implementation and sustainability topics of Session 3. Just like the first handbook, you can use this as a pre-reading guide, a companion during the live sessions, or a comprehensive self-learning resource for your staff.

Chapter 1: Rapid Prototyping Deep Dive

1.1 Rapid Prototyping: Beyond the “Sketch”

In Session 1, we briefly introduced rapid prototyping as the iterative process of quickly creating a working model of an idea to test and refine. In PME curriculum development, this approach is invaluable. It moves beyond theoretical discussions to hands-on experimentation, allowing you to:

- Test Assumptions Early. Validate whether your AI integration idea truly addresses a problem or enhances learning as you expect, before significant investment.
- Gather Early Feedback. Provide a tangible artifact for stakeholders (students, faculty, leadership) to react to, leading to more actionable and specific feedback.
- Iterate Quickly. The agile nature allows for rapid adjustments based on feedback, adapting to changing needs or emerging technologies.
- Reduce Risk. By 'failing fast' on a small scale, you minimize the resources committed to unproven concepts.

This iterative cycle of 'Idea, Prototype, Test, Refine' is central to agile instructional design in a dynamic environment.

1.2 Low-Fidelity Prototyping Methods for Learning Design

The key to rapid prototyping is using 'low-fidelity' methods. These are simple, inexpensive, and quick ways to represent your idea, focusing on functionality and interaction rather than polished aesthetics. This prevents over-investment in early concepts and encourages flexibility.

Common low-fidelity prototyping methods applicable to learning design include:

- Storyboarding. A visual narrative of the learner's journey through an activity, depicting key screens, interactions, and AI responses. Think of it like a comic strip for your learning experience. It helps clarify the flow and user experience.
- Paper Prototypes. Hand-drawn sketches or printouts of user interfaces, assignment prompts, or interactive elements. These are incredibly fast to

create, easy to modify (just draw over it), and excellent for testing basic usability and flow.

- Simple Digital Mockups. Using tools you likely already have (e.g., PowerPoint, Google Slides, or even basic LMS pages) to create static or semi-interactive representations of an AI-enhanced activity. This can simulate the look and feel without complex coding.
- Draft Assignment Prompts (GAI-Partnered). A written description of an assignment that explicitly outlines how a Generative AI tool should be used by the student, what output is expected from the AI, and how the student should critically engage with that output. This is a prototype of the instructions themselves.
- Role-Playing. Physically acting out the interaction between a learner, an instructor, and an AI tool. This can reveal unexpected challenges or opportunities in the user experience and workflow.

1.3 Designing for Feedback, Not Perfection

The mindset behind low-fidelity prototyping is crucial: you are designing for feedback, not for a finished product.

- Formulate Specific Questions. Before you prototype, identify what specific questions you want your prototype to answer. For example: "Do students understand the AI's role in this particular task?" or "Does this AI integration genuinely save instructor time on feedback?"
- Embrace “Fail Fast.” It's far more efficient to discover flaws or areas for improvement with a prototype that took minutes or hours to create, rather than after weeks or months of development. Each 'failure' is a valuable learning opportunity that informs the next iteration.
- Focus on the Core Idea. Resist the urge to make your prototype perfect. If it clearly communicates your core idea and allows for testing of key assumptions, it's successful.

Chapter 2: GAI-Partnered Learning Experience Design

2.1 Generative AI (GAI) as a Collaborative Partner

Generative AI (GAI), exemplified by tools like ChatGPT, Gemini, NIPRGPT, and Claude, represents a significant evolution in AI capabilities. For PME, the most impactful approach is to view GAI not as a replacement for human intellect, but as a powerful collaborative partner. This paradigm shift means GAI augments human capabilities, allowing instructors and learners to achieve more, not less.

- Augmenting Human Capabilities. GAI can assist with tasks such as brainstorming, drafting, summarizing, and generating diverse examples, freeing up cognitive load for higher-order thinking.
- Human Remains in Control. The human learner and instructor remain the ultimate arbiters of truth, judgment, and ethical considerations. GAI is a tool to be critically evaluated and refined, not blindly trusted.

2.2 Practical Prompt Engineering for Learning Design

The quality of GAI output is highly dependent on the quality of the input, or 'prompt.' Prompt engineering is the art of crafting effective instructions for GAI tools to elicit desired, relevant, and useful responses for learning design.

- Be Specific. Clearly define the AI's role (e.g., "Act as a PME instructor," "You are an intelligence analyst"), the task you want it to perform, the desired format (e.g., "list of 5 questions," "a two-paragraph summary"), and any constraints (e.g., "under 200 words," "focus on ethical dilemmas").
- Provide Context. Give the AI relevant background information, such as the learning objective, doctrinal principles, or a specific scenario (e.g., "Based on the provided case study about cyber warfare..."). The more context, the better the output.
- Iterate & Refine. Don't expect perfection on the first try. Experiment with different phrasings, add more detail, or break down complex requests into smaller steps. Learn from initial outputs and refine your prompts.
- Request Structured Output. Ask for specific formats like bulleted lists, tables, or outlines. This makes the AI's response easier to process and integrate into your learning materials.

- Example Prompt Strategy: To generate ethical dilemmas for a PME course: "Act as a PME instructor designing a scenario for junior officers. Create three distinct ethical dilemmas related to the use of AI in targeting decisions. For each dilemma, provide a brief background scenario (50-75 words) and two opposing viewpoints (25-30 words each). Ensure the dilemmas touch upon principles of the Law of Armed Conflict (LOAC) such as proportionality or distinction."

2.3 Defining Roles: Learner, Instructor, AI

Successful GAI integration requires us to clearly define the roles of all participants.

The Learner's Role

- Uses AI as a tool for initial research, brainstorming ideas, drafting content, or generating practice questions.
- Critically evaluates all AI output for accuracy, bias, relevance, and completeness.
- Synthesizes AI-generated content with their own critical thinking and research to produce original work.
- Discloses AI assistance transparently.

The Instructor's Role

- Designs assignments that strategically integrate AI to enhance learning outcomes.
- Teaches prompt engineering and critical evaluation skills.
- Provides human feedback, mentorship, and contextual understanding that AI cannot.
- Models responsible and ethical AI use.

The GAI's Role

- Generates text, summaries, ideas, scenarios, or provides initial feedback based on prompts.
- Acts as a sophisticated digital assistant to augment human cognitive processes.

2.4 Examples of GAI-Partnered Assignments for PME

Practical examples of how GAI can be integrated into PME assignments:

- AI as research assistant - Students use GAI to summarize a set of articles on a complex topic (e.g., hybrid warfare). Their assignment is to then write a 250-word critique of the AI's summary, identifying biases, omissions, or areas where human insight is superior.
- AI as scenario generator - Students prompt GAI to create 3-5 tactical scenarios for a specific operational environment (e.g., urban combat in a desert region). They then select one scenario, refine it with additional details, and justify their refinements based on doctrinal principles.
- AI as debate opponent - Students prepare an argument on a doctrinal principle. They then use GAI to generate counterarguments to their position. Their assignment is to prepare a rebuttal to the AI's arguments, demonstrating a deeper understanding of the topic.
- AI for initial feedback - Students draft a memo or report. They then use GAI to provide feedback on grammar, clarity, tone, or structure. They submit both their draft and the AI's feedback, along with a reflection on how they used the feedback to improve their work.
- AI for idea expansion - Students generate an initial Course of Action (COA). They then use GAI to brainstorm alternative COAs or potential enemy reactions, which they must then analyze and critique.

Chapter 3: Tools & Techniques in Your LMS for Prototyping

3.1 Leveraging LMS Activities for Prototyping AI Integration

You don't need specialized, expensive AI software to begin prototyping. Your existing Learning Management System (LMS) offers a robust suite of activities that can be creatively adapted for AI integration at both the content and metacontent levels:

- Assignments. Your LMS Assignment activity is perfect for designing GAI-partnered tasks. You can craft prompts that explicitly require students to use AI, submit its output, and then critically reflect on it. This allows for assessment of both the AI interaction and the student's critical judgment.
- H5P (Interactive Content). This powerful content plugin allows for the creation of rich, interactive experiences.
    - Branching Scenarios. Ideal for presenting ethical dilemmas related to AI, where learners make choices and receive immediate feedback on the consequences, as demonstrated in our 'Decision Point: Bias Detection' activity.
    - Drag the Words/Matching Activities. Excellent for reinforcing understanding of AI capabilities by matching terms to definitions or applications, as seen in our 'AI Capability Match-Up' demo.
- Interactive Videos. Embed videos and add questions or prompts at specific points, including questions about AI's role or ethical implications in the video's content.
- Discussion Forums. LMS Forums are excellent for facilitating rich, asynchronous discussions. They can be used for:
    - Debates on AI ethics (e.g., “Ethical Dimensions of AI in ISR”).
    - Sharing AI-generated content for peer critique and collaborative refinement.
    - Reflecting on the process of using AI in learning.
- Quizzes. Beyond traditional assessments, LMS Quizzes can be designed to:
    - Test critical evaluation of AI-generated content (e.g., identifying factual inaccuracies or biases in AI-produced text).
    - Assess conceptual understanding of AI capabilities and their limitations.
    - Include short answer or essay questions where students must articulate their reasoning about AI's role.

3.2 Tips for Creating Simple, Testable Prototypes in Your LMS

When building your prototypes within your LMS, keep these practical tips in mind.

- Start small. Don't try to prototype an entire curriculum. Focus on one specific learning objective or a single pain point identified in your curriculum analysis. This makes the task manageable and allows for focused testing.
- Use existing features creatively. Look at the default LMS activities and think about how they can be adapted. You don't necessarily need new plugins to begin experimenting with AI integration.
- Provide clear instructions. When designing your LMS activity, ensure the instructions for learners are explicit about AI's role, what output is expected from the AI, and how the learner is expected to critically engage with it. Transparency is key.
- Design for feedback. Structure your prototype to easily gather feedback. This might involve a simple survey linked at the end of an activity, or specific questions you ask during a peer review session. What do you want to learn from this prototype's initial use?
- Iterate, iterate, iterate. Be prepared to modify and re-test your prototype based on the feedback you receive. The beauty of rapid prototyping in the LMS is the ease with which you can make changes and try again.

Chapter 4: Preparing for Action – The Intersession Assignment 2

This chapter outlines the practical activity you will complete between Session 2 and Session 3. The intersession assignment is designed to help you *apply* the rapid prototyping principles and GAI-partnered design strategies from Session 2. You will *take one of the AI integration ideas you brainstormed in your first intersession homework* (Curriculum Analysis and Opportunity Mapping) and *develop it into a low-fidelity prototype*. This hands-on experience will solidify your understanding and provide a tangible artifact to share and refine in Session 3. The goal is to create something you could not have built without the insights gained from this series.

Intersession Assignment: Prototyping Your AI-Enhanced Learning Experience

- Workshop Series: Empowering PME with AI: A Practical Path Through Uncertainty
- Session: 2 - Rapid Prototyping AI-Powered Learning Experiences
- Assignment: Intersession Assignment 2: Prototyping Your AI-Enhanced Learning Experience
- Purpose: This assignment is your opportunity to apply the rapid prototyping principles and GAI-partnered design strategies from Session 2. You will take one of the AI integration ideas you brainstormed in your first intersession homework (Curriculum Analysis and Opportunity Mapping) and develop it into a low-fidelity prototype. This hands-on experience will solidify your understanding and provide a tangible artifact to share and refine in Session 3. The goal is to create something you could not have built without the insights gained from this series.
- Due Date: To be completed before Session 3
- Submission: Please be prepared to present and discuss your low-fidelity prototype in small groups during Session 3. You may bring it digitally in a range of forms (e.g., an LMS screenshare draft, a PowerPoint storyboard, a PDF of your paper prototype).

Instructions & Process Details:

- Please revisit your Intersession Assignment 1: Curriculum Analysis and Opportunity Mapping.
- Choose one of the 2-3 AI integration ideas you brainstormed for a specific module or learning objective.
- Your task for this assignment is to develop a low-fidelity prototype of that idea.

Step 1: Re-Select Your Focus (5-10 minutes)

- Review the AI integration ideas you generated in your first homework.
- Select the single idea that you find most compelling, most feasible to prototype, or that addresses a significant pain point in your curriculum.

- Briefly re-state the Course Name, Module/Objective Title, and your chosen AI Integration Idea from your previous work.

Step 2: Choose Your Prototyping Method (10-15 minutes)

- Based on the nature of your idea and your comfort level, choose a low-fidelity prototyping method. Consider:
    - LMS Activity Outline/Draft: If your idea directly involves a LMS activity (e.g., a GAI-partnered Assignment, an H5P scenario, a Discussion Forum prompt). You can draft the activity description, instructions, and settings within a sandbox LMS course or a Word document.
    - Storyboard: A series of simple sketches or slides (e.g., PowerPoint, Google Slides, hand-drawn) that visually map out the learner's interaction with the AI and the learning activity, step-by-step. Include key screens, prompts, and expected AI responses.
    - Paper Prototype: Hand-drawn mockups of the user interface or interaction flow. This is excellent for testing user experience.
    - Draft Assignment Prompt (GAI-Partnered): A detailed written prompt for students that explicitly outlines how they should use a GAI tool, what output to generate, how to critically evaluate it, and what human synthesis is required.
    - Role-Playing Script: A brief script outlining a hypothetical interaction between a student, an instructor, and an AI tool within your proposed activity.

Step 3: Develop Your Low-Fidelity Prototype (45-60 minutes)

- Build your prototype using your chosen method. Remember:
    - Focus on the core concept: Don't get bogged down in perfect visuals or full functionality. The goal is to represent the idea and the interaction clearly.
    - Show the AI's role: How does the AI contribute to the learning experience? What is its output or function?
    - Highlight the human element: How does the learner critically engage with the AI? What higher-order thinking is required?
    - Keep it simple: The less time it takes to build, the more flexible you can be with feedback and iteration.

Step 4: Prepare for Feedback (5-10 minutes)

- Identify 1-2 specific questions you have about your prototype that you'd like to ask your peers for feedback in Session 3. For example:
    - "Is the AI's role in this activity clear to the learner?"
    - "Does this activity genuinely promote critical thinking, or could it lead to over-reliance?"
    - "Is the assignment prompt clear enough for students to understand expectations?"
    - "Does this prototype effectively address the pain point I identified?"

Tips for Success:

- Refer to Your Handbook: Revisit Chapter 4, 'Introduction to Rapid Prototyping and GAI Partnership,' for guidance on methods and principles.
- Don't Over-Engineer: The beauty of low-fidelity is its simplicity. A rough sketch that clearly communicates your idea is more valuable than a half-finished, polished product.
- Think 'Testable': Design your prototype so that if someone were to interact with it (even mentally), you could gather insights on its effectiveness.
- Connect to Outcomes: Ensure your prototype clearly links back to the learning outcomes and doctrinal requirements you identified in your first homework.
- Embrace Imperfection: This is a learning process. Your prototype is a tool for discussion and refinement, not a final product.

What to Bring to Session 3:

- Your completed low-fidelity prototype (digital file ready to share (or shared in advance with facilitators).
- Your notes from Intersession Assignment 1, particularly your chosen AI integration idea and the problem it addresses.
- The 1-2 specific questions you have for peer feedback.
- This assignment will provide concrete examples for our discussions on implementation, evaluation, and sustainment in Session 3, truly demonstrating what you've gained from the series.

Chapter 5: Practical Integration Considerations

5.1 From Prototype to Implementation: The Next Hurdles

You've successfully developed a low-fidelity prototype. This is a significant step. However, moving from a testable idea to a fully deployed, impactful solution within a PME institution requires addressing several practical considerations. These hurdles go beyond instructional design and involve strategic planning across the organization. Key areas include:

- Policy & governance. Establish clear rules and oversight for AI use.
- Infrastructure & technical support. Ensure the necessary technological backbone and personnel are in place.
- Faculty development & buy-in. Equip and empower the educators who will implement and champion AI.

5.2 Policy & Governance Considerations

In the federal and military context, robust policy and governance are paramount for responsible AI integration.

- Clear AI usage policies. Develop explicit guidelines for both students and faculty.
    - For students: Address academic integrity, proper disclosure of AI assistance, and responsible use of AI tools.
    - For faculty: Provide guidance on using AI for content creation, assessment support, and feedback generation, ensuring human oversight remains paramount.
- Data governance. This is a non-negotiable. Establish stringent classification, privacy, and security protocols for any PME content or student data that interacts with AI systems. Understand how data is handled by commercial AI tools versus internal, DoD-approved solutions. Compliance with federal data regulations is critical.
- Ethical review boards/processes. Consider establishing formal processes or review boards to vet AI applications, especially those involving sensitive data, assessment, or operational scenarios. This ensures alignment with ethical principles and minimizes unintended consequences.

- Alignment with DoD AI ethical principles. Continuously ensure that all institutional policies and AI implementations align with the DoD's five ethical principles for AI (Responsible, Equitable, Traceable, Reliable, and Governable). These principles should serve as your guiding framework.

5.3 Infrastructure & Technical Support

Successful AI integration relies on a solid technological foundation and ongoing support.

- LMS capabilities. Assess whether your current LMS version and installed plugins are sufficient to support your AI integration plans. Newer LMS versions often have enhanced AI toolsets you can leverage, if those are made available in your instance.
- Access to AI tools. Determine whether you will leverage publicly available AI models (with strict data handling protocols) or if your institution requires access to internal, DoD-approved AI solutions. Consider network bandwidth and connectivity requirements.
- IT support. Identify who within your IT department or learning technology team will be responsible for maintaining, troubleshooting, and updating AI integrations. Clear lines of support are essential for faculty adoption. Who answers the questions that will inevitably arise?
- Scalability. Can your AI-enhanced solutions handle an increased user load if they are adopted widely across multiple courses, departments, or even the entire institution? Plan for growth from the outset.

5.4 Faculty Development & Buy-in

Technology adoption is fundamentally a human endeavor. Securing faculty buy-in and providing continuous development are critical for sustained success. How can you do this? Some ways I've seen work are:

- AI literacy training. Move beyond basic 'how-to' guides. Provide comprehensive training that covers prompt engineering, critical evaluation of AI outputs, strategies for detecting algorithmic bias, and ethical decision-making in AI contexts.
- Show, don't just tell. Demonstrate the practical benefits of AI for faculty's own workload (e.g., time saved on administrative tasks, enhanced content

creation) and for student learning. Real-world examples from peers are powerful motivators.

- Champions & early adopters. Really, this is you. But who else can you bring aboard? Identify and empower faculty members who are enthusiastic about AI. These individuals can serve as internal champions, modeling effective use and inspiring their colleagues.
- Community of practice. Foster a supportive environment for ongoing learning and collaboration. This could be a dedicated LMS or Teams forum, a Sharepoint site (which I've used several times to great effect) regular informal meetings, or a shared resource hub where faculty can exchange ideas, successes, and troubleshoot challenges together.

Chapter 6: Evaluating Impact & Sustaining Innovation

6.1 Measuring GAI's Impact in PME

To ensure your AI initiatives are truly effective, you must move beyond simply 'using AI' to rigorously measuring its impact. This involves assessing whether AI is genuinely enhancing learning, improving efficiency, and aligning with ethical standards.

- Focus on learning outcomes. The primary goal is improved student learning and development of critical skills, not just AI usage statistics.
- Assess efficiency gains. Quantify the time or resources saved by instructors and developers.
- Assess learning stickiness and retention gains. Quantify the reduced learning loss.
- Monitor ethical compliance. Continuously check for unintended consequences, biases, or privacy breaches.

6.2 Key Metrics for Evaluation

Consider incorporating a mix of quantitative and qualitative metrics to evaluate your AI-enhanced learning experiences, which might include:

- Student Learning Outcomes.
    - Compare performance on pre/post-assessments for AI-enhanced modules.
    - Analyze the quality of student work on AI-integrated assignments (e.g., how well do GAI-augmented reports demonstrate critical analysis and synthesis?).
    - Assess the development of critical thinking and problem-solving skills in AI-related tasks.
- Student Engagement
    - Track participation rates and depth of engagement in AI-enhanced activities (e.g., forum discussions on AI ethics, H5P scenario completion).
    - Gather qualitative feedback through surveys or focus groups on student perceptions of AI's helpfulness and usability.

- Instructor Efficiency
    - Collect data on time saved by instructors on specific tasks (e.g., grading objective questions, generating lesson ideas, providing initial draft feedback).
    - Assess the perceived reduction in administrative burden for faculty.
- Feedback Quality
    - Evaluate whether AI-generated feedback is actually leading to improved student revisions and learning.
    - Compare student revisions based on AI feedback versus human feedback.
- Perceived Utility & Trust
    - Conduct surveys to gauge faculty and student perceptions of AI's helpfulness, reliability, and trustworthiness in their learning and teaching processes.
    - Monitor for signs of 'automation bias' or over-reliance.

6.3 Building a Sustainable Community of Practice

Innovation thrives in collaborative environments. A sustainable community of practice is essential for long-term AI integration.

- Purpose - Create a dedicated space for sharing best practices, collaboratively troubleshooting challenges, fostering peer-to-peer learning, and driving continuous innovation in AI application.
- Structure - Establish regular meetings (virtual or in-person), create a dedicated communication channel (e.g., an LMS forum in your faculty development site, Microsoft Teams channel, or internal wiki), and maintain a shared repository of successful AI-enhanced activities and resources.
- Leadership - Identify and empower faculty champions who can lead discussions, share their experiences, and mentor others. Consider rotating facilitation roles to build capacity.
- Celebrate successes - Actively share and celebrate big and small wins. Highlighting positive impacts (e.g., a student's breakthrough, an instructor's time-saving strategy) builds momentum and encourages broader adoption.

Conclusion & Next Steps

This three-part workshop series has provided a practical path to empowering PME with AI. We've moved from understanding the strategic landscape and ethical considerations to hands-on prototyping, and finally, to the critical aspects of implementation and sustainment.

Your dedication to applying these concepts is vital. By leveraging AI as a strategic enabler, maintaining human oversight, and fostering a culture of continuous learning and collaboration, you are directly contributing to the development of adaptable, critical-thinking warfighters prepared for the complexities of the future.

We encourage you to continue the conversation, share your successes and challenges, and remain active participants in this evolving field. Your work is making a difference.

9. Appendix A: Glossary of Key AI Terms

- Artificial Intelligence (AI): Systems that mimic human intelligence to perform tasks.
- Machine Learning (ML): A subset of AI where systems learn from data without explicit programming.
- Natural Language Processing (NLP): AI's ability to understand, interpret, and generate human language.
- Generative AI (GAI): AI capable of creating new content (text, images, etc.) based on learned patterns.
- Augmented Intelligence: AI used to enhance human capabilities, not replace them.
- Algorithmic Bias: Systematic and repeatable errors in an AI system's output due to biased training data or flawed algorithms.
- Transparency (in AI): The ability to understand how an AI system makes its decisions or generates its outputs.
- Explainable AI (XAI): AI systems designed to provide explanations for their outputs, making them more transparent and understandable to humans.
- Human-in-the-Loop: A design principle where human oversight and intervention are integrated into AI-driven processes.
- Rapid Prototyping: An iterative design process focused on quickly building and testing low-fidelity models to gather feedback and refine ideas.
- Low-Fidelity Prototype: A simplified, often non-functional, representation of a design idea used for early testing (e.g., sketches, storyboards, paper mockups).
- Prompt Engineering: The art and science of crafting effective inputs (prompts) for AI models to achieve desired outputs.
- OPMEP: Officer Professional Military Education Policy (specific to US military education).
- ISR: Intelligence, Surveillance, and Reconnaissance.
- Automation Bias: The propensity for humans to favor suggestions from automated systems, even when contradictory information is available.
- Digital Literacy: The ability to find, evaluate, create, and communicate information using digital technologies, including AI.

10. Appendix B: Focused Bibliography

To follow up from our Session 1 conversation on attention, memory formation, event-related potentials, and cognitive processing, we offer this focused bibliography of scholarship that has provided an entry point to these areas and their intersections.

Bak, Marek, and Marek Zmyślony. “Effects of electromagnetic field from cellular phones on selected central nervous system functions: a literature review.” *Medycyna pracy* 61, no. 6 (2010): 671–683.

Bastiaansen, Marcel, Lilla Magyari, and Peter Hagoort. “Syntactic Unification Operations Are Reflected in Oscillatory Dynamics During On-Line Sentence Comprehension.” *Journal of cognitive neuroscience* 22, no. 7 (2010): 1333–1347. DOI: 10.1162/jocn.2009.21283

Bentin, Shlomo, Joseph M DeGutis, Mark D’Esposito, and Lynn C Robertson. “Too Many Trees to See the Forest: Performance, Event-Related Potential, and Functional Magnetic Resonance Imaging Manifestations of Integrative Congenital Prosopagnosia.” *Journal of cognitive neuroscience* 19, no. 1 (2007): 132–146. DOI: 10.1162/jocn.2007.19.1.132

Bentin, Shlomo, and Leon Y. Deouell. “STRUCTURAL ENCODING AND IDENTIFICATION IN FACE PROCESSING: ERP EVIDENCE FOR SEPARATE MECHANISMS.” *Cognitive neuropsychology* 17, no. 1-3 (2000): 35–55. DOI: 10.1080/026432900380472

Berkum, Jos J. A. van, Peter Hagoort, and Colin M. Brown. “Semantic Integration in Sentences and Discourse: Evidence from the N400.” *Journal of cognitive neuroscience* 11, no. 6 (1999): 657–671. DOI: 10.1162/089892999563724

Carmel, David, and Shlomo Bentin. “Domain Specificity Versus Expertise: Factors Influencing Distinct Processing of Faces.” *Cognition* 83, no. 1 (2002): 1–29. DOI: 10.1016/S0010-0277(01)00162-7

Chwilla, Dorothee J, and Herman H.J Kolk. “Event-Related Potential and Reaction Time Evidence for Inhibition Between Alternative Meanings of Ambiguous Words.” *Brain and language* 86, no. 2 (2003): 167–192. OI: 10.1016/S0093-934X(02)00527-8

Federmeier, Kara D., and Marta Kutas. “Aging in Context: Age-Related Changes in Context Use During Language Comprehension.” *Psychophysiology* 42, no. 2 (2005): 133–141. DOI: 10.1111/j.1469-8986.2005.00274.x

Federmeier, Kara D, and Marta Kutas. “Right Words and Left Words: Electrophysiological Evidence for Hemispheric Differences in Meaning Processing.” *Brain research. Cognitive brain research* 8, no. 3 (1999): 373–392. DOI: 10.1016/S0926-6410(99)00036-1

Federmeier, Kara D, Edward W Wlotko, Esmeralda De Ochoa-Dewald, and Marta Kutas. “Multiple Effects of Sentential Constraint on Word Processing.” *Brain research* 1146 (2007): 75–84. DOI: 10.1016/j.brainres.2006.06.101

Friederici, Angela D, Karsten Steinhauer, Axel Mecklinger, and Martin Meyer. “Working Memory Constraints on Syntactic Ambiguity Resolution as Revealed by Electrical Brain Responses.” *Biological psychology* 47, no. 3 (1998): 193–221. DOI: 10.1016/S0301-0511(97)00033-1

Henson, R. N. A, M. D Rugg, T Shallice, O Josephs, and R. J Dolan. “Recollection and Familiarity in Recognition Memory: An Event-Related Functional Magnetic Resonance Imaging Study.” *The Journal of neuroscience* 19, no. 10 (1999): 3962–3972. DOI: 10.1523/jneurosci.19-10-03962.1999

Hillyard, S A, and M Kutas. “Electrophysiology of Cognitive Processing.” *Annual review of psychology* 34, no. 1 (1983): 33–61. DOI: 10.1146/annurev.ps.34.020183.000341

Keppel, Geoffrey., and Sheldon. Zedeck. *Data Analysis for Research Designs : Analysis-of-Variance and Multiple Regression/correlation Approaches*. New York: W.H. Freeman, 1989.

Koen, Joshua D, Erin D Horne, Nedra Hauck, and Michael D Rugg. “Age-Related Differences in Prestimulus Subsequent Memory Effects Assessed with Event-Related Potentials.” *Journal of cognitive neuroscience* 30, no. 6 (2018): 829–850. DOI: 10.1162/jocn_a_01249

Kolk, Herman, and Dorothee Chwilla. “Late Positivities in Unusual Situations.” *Brain and language* 100, no. 3 (2007): 257–261. DOI: 10.1016/j.bandl.2006.07.006

Kotchoubey, B., E. Wascher, and R. Verleger. “Shifting Attention Between Global Features and Small Details: An Event-Related Potential Study.” *Biological psychology* 46, no. 1 (1997): 25–50. DOI: 10.1016/S0301-0511(96)05236-2

Ković, Vanja, Platon Sovilj, and Dejan Lalović. “EXPLORING ALTERNATIVES FOR VISUAL WORD GRAMMATICAL PRIMING PROCEDURE: AN ERP STUDY.” *Primenjena psihologija (Online)* 11, no. 1 (2018): 127–142. DOI: 10.19090/pp.2018.1.127-142

Kutas, Marta, and Steven A. Hillyard. “An Electrophysiological Probe of Incidental Semantic Association.” *Journal of cognitive neuroscience* 1, no. 1 (1989): 38–49. DOI: 10.1162/jocn.1989.1.1.38

Kutas, Marta, Vicente Iragui, Yu-Qiong Niu, Tanya D’Avanzo, Jin-Chen Yang, David Salmon, Lin Zhang, and John Olichney. “Altered N400 Congruity Effects in Parkinson’s Disease Without Dementia.” *Journal of Cognitive Neuroscience. Supplement* (2013): 190–191.

Lang, Simone, Nadine Kanngieser, Piotr Jaśkowski, Hilde Haider, Michael Rose, and Rolf Verleger. “Precursors of Insight in Event-Related Brain Potentials.” *Journal of cognitive neuroscience* 18, no. 12 (2006): 2152–2166. DOI: 10.1162/jocn.2006.18.12.2152

Mouchetant-Rostaing, Y., and M. H. Giard. “Electrophysiological Correlates of Age and Gender Perception on Human Faces.” *Journal of cognitive neuroscience* 15, no. 6 (2003): 900–910. DOI: 10.1162/089892903322370816

Olichney, J M, S K Morris, C Ochoa, D P Salmon, L J Thal, M Kutas, and V J Iragui. “Abnormal Verbal Event Related Potentials in Mild Cognitive Impairment and Incipient Alzheimer’s Disease.” *Journal of neurology, neurosurgery and psychiatry* 73, no. 4 (2002): 377–384. DOI: 10.1136/jnnp.73.4.377

Opitz, B, A Mecklinger, and A D Friederici. “Functional Asymmetry of Human Prefrontal Cortex: Encoding and Retrieval of Verbally and Nonverbally Coded Information.” *Learning & memory (Cold Spring Harbor, N.Y.)* 7, no. 2 (2000): 85–96. DOI: 10.1101/lm.7.2.85

Perrin, Fabien, Luis Garćıa-Larrea, François Mauguière, and Hélène Bastuji. “A Differential Brain Response to the Subject’s Own Name Persists During Sleep.” *Clinical neurophysiology* 110, no. 12 (1999): 2153–2164. DOI: 10.1016/S1388-2457(99)00177-7

Perrin, Fabien, and Luis Garćia-Larrea. “Modulation of the N400 Potential During Auditory Phonological/semantic Interaction.” *Brain research. Cognitive brain research* 17, no. 1 (2003): 36–47. DOI: 10.1016/S0926-6410(03)00078-8

Rugg, Michael D., Michael C. Doyle, and Tony Wells. “Word and Nonword Repetition Within- and Across-Modality: An Event-Related Potential Study.” *Journal of cognitive neuroscience* 7, no. 2 (1995): 209–227. DOI: 10.1162/jocn.1995.7.2.209

Sagiv, Noam, and Shlomo Bentin. “Structural Encoding of Human and Schematic Faces: Holistic and Part-Based Processes.” *Journal of cognitive neuroscience* 13, no. 7 (2001): 937–951. DOI: 10.1162/089892901753165854

van de Meerendonk, Nan, Herman H. J. Kolk, Constance Th. W. M. Vissers, and Dorothee J. Chwilla. “Monitoring in Language Perception: Mild and Strong Conflicts Elicit Different ERP Patterns.” *Journal of cognitive neuroscience* 22, no. 1 (2010): 67–82. DOI: 10.1162/jocn.2008.21170

Smith, Adam P. R, Raymond J Dolan, and Michael D Rugg. “Event-Related Potential Correlates of the Retrieval of Emotional and Nonemotional Context.” *Journal of cognitive neuroscience* 16, no. 5 (2004): 760–775. DOI: 10.1162/089892904970816

van Herten, Marieke, Dorothee J Chwilla, and Herman H. J Kolk. “When Heuristics Clash with Parsing Routines: ERP Evidence for Conflict Monitoring in Sentence Perception.” *Journal of cognitive neuroscience* 18, no. 7 (2006): 1181–1197. DOI: 10.1162/jocn.2006.18.7.1181

Verleger, Rolf, and Piotr Jaśkowski. “Disentangling Neural Processing of Masked and Masking Stimulus by Means of Event-Related Contralateral — Ipsilateral Differences of EEG Potentials.” *Advances in Cognitive Psychology* 3, no. 1-2 (2008): 193–210. DOI: 10.2478/v10053-008-0025-0

Vieregge, P., B. Wauschkuhn, I. Heberlein, J. Hagenah, and R. Verleger. “Selective Attention Is Impaired in Amyotrophic Lateral Sclerosis—a Study of Event-Related EEG Potentials.” *Brain research. Cognitive brain research* 8, no. 1 (1999): 27–35. DOI: 10.1016/S0926-6410(99)00004-X

Vissers, Constance Th.W.M., Dorothee J. Chwilla, and Herman H.J. Kolk. “Monitoring in Language Perception: The Effect of Misspellings of Words in Highly Constrained Sentences.” *Brain research* 1106, no. 1 (2006): 150–163. DOI: 10.1016/j.brainres.2006.05.012

Wang, L, MCM Bastiaansen, Y Yang, and P Hagoort. “Information Structure Influences Depth of Syntactic Processing: Event-Related Potential Evidence for the Chomsky Illusion.” *PLoS ONE* 7, no. 10 (2012): e47917–e47917. DOI: 10.1371/journal.pone.0047917

Yamaguchi, Shuhei, Laura A Hale, Mark D’Esposito, and Robert T Knight. “Rapid Prefrontal-Hippocampal Habituation to Novel Events.” *The Journal of neuroscience* 24, no. 23 (2004): 5356–5363. DOI: 10.1523/JNEUROSCI.4587-03.2004

Yamaguchi, S, and RT Knight. “Anterior and Posterior Association Cortex Contributions to the Somatosensory P300.” *The Journal of neuroscience* 11, no. 7 (1991): 2039–2054. DOI: 10.1523/jneurosci.11-07-02039.1991

In Session 1, I provided an off the cuff entry point to many of these ideas. For this bibliography, I’ve tried to offer a range of resources that might help you dig in to what interests you most. This collection of scholarship demonstrates how ERPs are used to study various aspects of human cognition. In the “choose your adventure” spirit, you can pursue any of these themes:

1. Language and Semantic Processing: A significant portion of this list investigates *how the brain processes language.* Many of these studies focus on the N400 component, a negative-going ERP that peaks around 400 milliseconds after a stimulus. The N400 is a classic indicator of semantic processing and is often *seen when a word is semantically incongruous with its context.* This research explores:
    a. Contextual integration - How the N400 reflects the brain's attempt to integrate a word into the meaning of a sentence or discourse (e.g., Kutas & Hillyard, Berkum et al.).
    b. Ambiguity and inhibition - How the brain resolves conflicting meanings of ambiguous words (e.g., Chwilla & Kolk).
    c. Syntactic processing - Other studies examine how the brain handles grammar and sentence structure, sometimes in combination with semantic information (e.g., Bastiaansen et al., Friederici et al.).

    d. Aging and language - Some papers explore how language processing and the use of context change with age (e.g., Federmeier & Kutas).
2. Memory and Retrieval - Another major theme is the role of ERPs in memory. These studies look at the neural signals associated with forming new memories and retrieving old ones.
    a. Recognition and familiarity - Research distinguishes between "recollection," where you recall specific details of an event, and "familiarity," a feeling of knowing something without specific details. ERPs can differentiate these processes (e.g., Henson et al.).
    b. Aging and memory - Similar to language, some research explores how memory-related brain activity changes in older adults or in conditions of cognitive impairment, such as early-stage Alzheimer's disease (e.g., Olichney et al., Koen et al.).
3. Face Perception - This group of papers explores how the brain processes faces, which is a specialized cognitive function.
    a. Holistic vs. part-based processing - Research by Bentin and Sagiv examines whether faces are processed as a whole ("holistic") or by individual features ("part-based").
    b. Specificity and expertise - Other studies investigate the neural correlates of perceiving age, gender, or whether face processing is a truly "domain-specific" ability or a form of visual expertise (e.g., Carmel & Bentin, Mouchetant-Rostaing & Giard).
    c. Disorders of face recognition - One paper explores prosopagnosia, the inability to recognize faces, and what ERPs reveal about its underlying causes (e.g., Bentin et al.).
4. Attention and Other Cognitive Functions - A smaller cluster of papers examines how ERPs are modulated by other cognitive processes.
    - Attention - This includes studies on shifting attention between different features of a stimulus or the neural correlates of selective attention (e.g., Kotchoubey et al., Vieregge et al.).
    - Insight and Novelty - Some papers use ERPs to study the brain's response to flashes of insight or to novel, unexpected stimuli (e.g., Lang et al., Yamaguchi et al.).

Enjoy!