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Working 'Failure' Into Your Learning Design

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ABSTRACT

The world is grappling with education failing to meet industry demands for skills. We're constantly striving to design for learning that is able to meet with the emerging societal and Industrial needs. Against this background what should the learning design strategy be? Of particular relevance is Productive Failure (PF) a deeper learning design strategy, which runs counter to a traditional Direct Instruction methodology and demonstrates the affordances of experiencing and learning from failure. This brief elaborates on PF, select use cases and applications as well as key design features in operationalizing PF.

Keywords: Collaborative/Constructivist Learning, Creativity, Digital Literacy/Citizenship, Diversity, ELDj (Emerging Learning Design Journal Special Issue), Games and Gamification, Learning From Failure, Mobile Learning, STEAM, Virtual Worlds and Virtual | Augmented Reality

Learning Design is faced with evolving world challenges. Perhaps the greatest of these is to acknowledge and be informed by global transformations impacting learning in the current volatile, uncertain, complex, and ambiguous world. The World Economic Forum's (WEF) Mapping Global Transformations (2018, a) report highlights macro trends shaping education and training, some of which are: delivering quality basic education, innovation in education, differentiating instruction, curricula for 21st century incorporating digital fluency and STEAM skills as well as Continuing Lifelong Learning.

Additionally, The Future of Jobs Report, 2018, surfaces high levels of youth unemployment and corresponding skills for the current and future workforce to be equipped with. Against this canvas of macro trends such as education-to-employment gap, future of jobs, in-demand skills; learning and pedagogical design will be integral in preparing learners for this transformative world (Markauskaite, & Goodyear, 2017; WEF, 2018, b).

A notable shift in learning design is moving from expert-dominated to expert-enabled learning designs (Kapur, 2014; Jacobson et.al., 2017; Markauskaite, & Goodyear, 2017) where learners assume roles of expert and be co-creators in their epistemic knowledge (Markauskaite, & Goodyear, 2017). This is where Productive Failure is relevant, as it creates an environment where learners immerse themselves as discipline experts, to gain deep perspectives through role playing and embodying experts' habits while traversing ambiguous, complex and unforeseen environments.

Productive Failure (PF) and How It Works

PF learning design "affords students opportunities to generate representations and solutions to a novel problem that targets a concept they have not learned yet, followed by consolidation and knowledge assembly where they learn the targeted concept" (Kapur, 2015). Briefly, such a LD embodies four core interdependent mechanisms: (a) activation, (b) awareness, (c) motivation, and (d) assembly. Breaking it down, learners start with a complex, novel problem without no background of the core concept. In the PF process, learners are required to investigate and explore the problem thereby generating possible outcomes which invariably lead to 'failure' to arrive at the 'correct solution'. Such a 'trial and error' exercise requires learners to (a) activate the required prior knowledge (PK) for trialing out the problem, thereby exploring novel ways in reaching an outcome, whether incorrect or not (Kapur, 2015). This activation of PK (b) engages learners in the process of being aware, being able to differentiate the various affordances and constraints of

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the multiple representations of solutions generated, and there by , (c) motivating them to search the unknown and (d) finally preparing learners for the consolidation (knowledge assembly) phase or the instruction by the expert (Kapur & Bielaczyc, 2012). In this last PF phase, the expert scaffolds learners' learning and brings the attention back to the critical conceptual features of the targeted concepts.

This methodology is contrary to a traditional teaching and learning approach where learners are initially 'taught'/ 'explicitly instructed' on what to look out for, and 'understand the what's and why's' underlying concepts and causal relations (Gysi, 2017). The value of PF lies in the fact that it promotes the experience of "failure" as a motivating factor in learning, letting learners experience novels ways to learn through self-created learning paths. Unlike problem-based learning, tasks and environments designed in PF, are for 'failure'. Experts resist the urge to scaffold up until the consolidation phase. Further, the learning does not take place in isolation, but rather as a collaborative effort between learners allowing them to compare and contrast affordances and constraints of multiple solutioning methods (Kapur, 2015).

Research on PF surfaces that learners discern and understand domain specific patterns, representations and methods when they attempt, explain, reason and evaluate multiple possible solutions underlying the situation at hand (Kapur, 2014; Jacobson et. al., 2017). Further, the higher and deeper learning gains are also supported by embracing a collaborative learning cycle, thereby preparing learners for 21st century skills (Gysi, 2017).

PF across Disciplines: Selected Research and Application

1. **PF in Mathematics.** Kapur (2011) paper investigates 'lecture and practice', PF and 'Facilitated Problem Solving' instructional designs on the unit of rate and speed for 7th grade mathematics students. Findings suggest that learners in PF created diverse representations and methods whilst solving the complex math sums and significantly outperformed counterparts in post-tests on both well-structured as well as higher-order application problems.
2. **Learning about climate change as a complex system** (Jacobson et.al., 2017). The paper highlights how complex ideas and difficult science concepts can be taught using PF as a learning design. The 9th grade learners solved challenges using agent-based models to learn about complex systems and its causal relations in climate change. PF students scored higher in near and far transfer of knowledge, compared to learners that experienced direct and explicit instructions regarding these concepts.
3. **Learning through collaborative virtual worlds**. PF can be imbued with elements of play. This presentation illustrates the use of 3D virtual worlds for scientific inquiry and learning, as an instructional anchor. Engaging learners in complex problems with less symmetrical and explicit direct instructions coupled with Role playing proved engaging and had a positive impact on attitudes to science (Newstead, & Jacobson, 2012).
4. **DIY PF boosting performance in a large undergraduate biology course.** This paper highlights the potential of PF approach when learning basic biology and science procedures and processes, over being explicitly taught the same. The paper highlights that low-performing students improved significantly (Chowrira., Smith, Dubois, & Roll, 2019).
5. **PF in a market ready EdTech product: Pallas Advanced Learning System (Pallas).** Pallas is a research-based Education Technology startup from Sydney, Australia. Pallas provides virtual science kits (VSK) using immersive technology, tools like NetLogo, which enable visualizations for advanced learning systems for STEM subjects.

   The product is innovative since it recalibrates the role of the teacher, is research informed as opposed to being based on teacher/institutional hunches. The VSK substitutes early Direct Instruction with 'guided failure'. Here learners are required to solve real world challenges by 'activating their intuitive experiences, informal knowledge and reasoning' (Pallas, n.d.; Saxena, 2019).

Working 'Failure' Into Your Learning Design

'Failure' as a learning strategy requires a mindset shift and a solid grounding in the workings of PF.

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Further to the above mentioned four core PF mechanisms and the PF process, below is a snapshot of key design features in operationalizing PF.

PF design problems should afford safe spaces for exploration and require activation of formal and intuitive prior knowledge. For instance, rather than demonstrating the effect of alkalinity on soil followed by the application of the concepts taught; learners in PF investigate alkaline soil, compare and contrast it to acidic soil along with their hypotheses and inferences towards the concept.

Secondly, the investigation should be challenging yet not frustrating and demotivating for learners. For example, rather than lecturing learners on civil procedures and court processes, perhaps in PF learners could be tasked to role play lawyers, judges with the outcome being the civil procedure and processes themselves.

Third, build space for learners to iterate, explain and elaborate on the problem, its solutioning process, as well as opportunities to compare and contrast respective affordances and constraints of failed or sub-optimal representations (Kapur & Bielaczyc, 2012).

The PF learning experience also requires the designer and the facilitator to toggle between the perspectives of both the learner as well as the discipline expert to create the multi-representational problems. Further, the designer and the facilitator have to resist the impulse of overguiding or scaffolding before the learner has attempted the task, to their maximum ability. Learning Science researchers highlight that the role of a facilitator and expert is one who empowers the learners in co-creating their epistemic knowledge (Kapur 2011; Markauskaite, & Goodyear, 2017).

PF can be challenging for facilitators who lack familiarity with the pedagogy and are used to working off a fixed curriculum. PF facilitation requires resisting the urge for scaffolding, letting time go by for when learners were exploring.

To sum up, this brief offers an introduction to PF as a learning design with reference to select use cases and pointers drawn from research and experience to aid in operationalizing PF. The references include additional information about the nuances and opportunities of PF to support learning.

REFERENCES

Chowrira, S. G., Smith, K. M., Dubois, P. J., & Roll, I. (2019). DIY productive failure: boosting performance in a large undergraduate biology course. NPJ science of learning, 4(1), 1.

Gysi, S. (2017, May 29). Productive failure produces learning outcomes for the 21st century [Blog Post]. Blog on Learning & Development. Retrieved from https://bold.expert/productive-failure-produces-learning-outcomes-for-the21st-century/

Jacobson, M. J., Markauskaite, L., Portolese, A., Kapur, M., Lai, P. K., & Roberts, G. (2017). Designs for learning about climate change as a complex system. Learning and instruction, 52, 1-14.

Kapur, M. (2011). A further study of productive failure in mathematical problem solving: Unpacking the design components. Instructional Science, 39(4), 561-579.

Kapur, M., & Bielaczyc, K. (2012). Designing for productive failure. Journal of the Learning Sciences, 21(1), 45-83.

Kapur, M. (2014). Productive failure in learning math. Cognitive Science, 38(5), 1008-1022. http://doi.org/10.1111/ cogs.12107

Kapur, M. (2015). Learning from productive failure. Learning: Research and practice, 1(1), 51-65.

Markauskaite, L., & Goodyear, P. (2017). Epistemic fluency and professional education. Dordrecht: Springer.

Newstead, A., & Jacobson, M. J. (2012). Collaborative Virtual Worlds for Enhanced Scientific Understanding.

Pallas. (n.d.). Pallas Advanced Learning Systems. Retrieved from https://pallasals.com/ on 1 Feb, 2018

Saxena, N. (2019). Pallas Advanced Learning Systems–A research-informed virtual learning kit. Journal of Applied Learning and Teaching, 2(1), 65-68.

World Economic Forum. (2018, a). Global transformations and issues World Economic Forum. Mapping Global Transformations. Retrieved from https://toplink.weforum.org/knowledge/insight/a1Gb0000000LPFfEAO/explore/summary

World Economic Forum. (2018, b). The Future of Jobs Report. Retrieved from http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf

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