



Does the use of the TPACK model enhance digital pedagogies: We don't understand the present so how can we imagine the future?

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This paper reflects on the use of the TPACK model in e-learning courses to enhance students' ability to use technology in their learning and later in their professions and to introduce the concept of *digital pedagogies*. To maximize students' learning, this model was disseminated in the design of the course, the learning activities and the assessment. The aim was to encourage students to become reflective learners and to create knowledge collaboratively. Different technological tools such as iPads, ePortfolio together with *digital pedagogies* were used to enhance the students' learning experience and obtain students' reflections and feedback on the unit. *Digital pedagogies* refer to teaching-learning approaches in which new technologies change the way we teach. From the thirty postgraduate students in the unit, there were different responses to digital pedagogies. Some felt it transformed their learning while others resisted and did not participate in the interactive spirit of the class.

Keywords: e-learning, TPACK model, digital pedagogies, collaborative learning

Introduction

As the world becomes more connected and work more collaborative (Johnson, Adams & Cummins, 2012), the impact of new technologies on teaching requires a pedagogical shift. My goal as an educator is to integrate technology, pedagogy and content knowledge (TPACK) (see Figure 1) to maximise learning. Therefore for many years, I have developed innovative pedagogies using new technologies to encourage students to become active and reflective learners and to create knowledge collaboratively (Maor, 2003, 2008; Maor, & Fraser, 1996). In recent years, I also introduced Reading, Reflecting, Displaying and Doing model (R2D2), (Bonk & Zhang, 2008) to my students to capitalise on students' differences and learning styles.

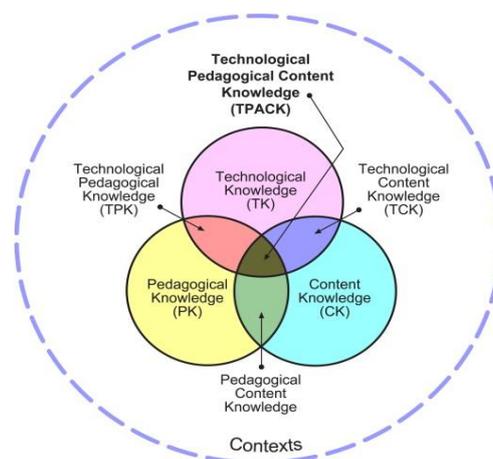


Figure 1. TPACK image <http://tpack.org/>

In many educational settings the discussion has already shifted from how to use technology to how students are learning. Researchers are focusing on the relevancy to the learners rather than on any particular tool that will be the key to learning. The increased use of technology in higher education creates a challenge of how best to utilise the technology for different purposes to maximize learning. There were great expectations that technology would change education, in particular that technology would enable greater accessibility and therefore increase the quality of teaching and learning in higher education. However, the argument exists that unless there is an emphasis on introducing the concept of *digital pedagogies* in teaching, there is not going to be a big change in education. *Digital pedagogies* refer to teaching–learning approaches in which digital technologies change the way we teach in order to promote learning. According to Kember (2008), digital pedagogies can refer to (but not only) personalized and authentic learning, learning in the global context and broader experiences and deeper learning. Yaniv (2008) suggests that the main initiative for the adoption of new technologies should be the need created by pedagogical concepts that could not be applied without technology. Developing digital pedagogies as a way of reframing pedagogies to better meet the needs of current and future students is an imperative in a digital world (Kember, 2008). Dron (2012) presents a different view. He suggests that the “widespread orthodoxy in the field of educational technology that pedagogies matter more than technologies and should come first when planning any sort of learning activity” (p. 23) needs to be challenged. Pedagogies are, in a very real and fundamental sense, themselves technologies insofar as they represent a set of techniques and tools for learning, and are as much technologies as the computers, forums, virtual classrooms and institutional structures in which they are used (p. 23). Therefore, Dron claims that there is no separation between digital pedagogies and technology. In other words, if our technological/pedagogical systems are to work, we need to understand the interdependencies between their parts (p.27).

With the increased use of Web2.0 and social media technologies for teaching, there is a necessity to frame our teaching in a more integrated and meaningful way. One such framework is TPACK which integrates teaching and technology in a critical way. Mishra and Koehler (2006) with their seminal work on the TPACK model enabled a new way of thinking about technology integration that emphasised the intersection of three domains of knowledge: technological, pedagogical and content knowledge (TPACK).

The literature suggests that there is a steady increase in the use of the TPACK framework, in particular in teacher education among pre-service teachers (Hechter, 2012; Yourdakul, Odabasi, Kilicer, Coklar, Birinci & Kurt, 2012). This together with accumulated research knowledge (Harris & Hofer, 2009; Dawson, 2007; Pierson, 2008; Harris 2008) helps us to think about technology integration with pedagogical content knowledge as an inspirational goal (Mishra & Koehler, 2006; Koehler & Mishra, 2009).

In teaching a unit that linked the theory and praxis of e-learning, I integrated two models: TPACK and R2D2 (Read, Reflect, Display and Do) (Bonk & Zhang, 2008) and underpinned it with the use of a social constructivist-oriented pedagogy (von Glaserfeld, 1989, Duffy, & Cunningham, 1996, Maor, 2003, 2008). I also used a blended learning approach with mobile technologies such as iPads, ePortfolio and other applications. The TPACK model facilitated my planning, implementation and assessment.

I wanted to develop digital pedagogies that would motivate and inspire students to learn. I also wanted to demonstrate these digital pedagogies that were aligned with the following learning attributes that students could adopt and carry into their own teaching:

- Interaction: Students engage in frequent, focused discussions with peers and the teacher.
- Peer learning: Students contribute reflective comments to peer conversations, on- and offline.
- Discussion leader: Students take a rotational leadership role as online facilitators.
- Facilitation: The teacher stimulates the discussion, presents core questions and topics, and challenges the students.
- Reflective practice: Students create reflective online journals in which they use technology to demonstrate their understanding and transformation of thinking over time.

To create digital pedagogies based on these constructivist learning principles, I had to make decisions about how to use the new technologies, what to use, when and for what purposes in relation to theories of learning and assessment (Lawless & Pellegrino, 2007). In addition, connectivity between people, according to Siemens (2006), changes the way people access, interact with, and process knowledge and therefore engagement with knowledge became more important than the knowledge itself. Thus the use of digital pedagogies moved the focus from technology and skills to a different way of working in a digital world.

Historical perspective of the development of TPACK

Shulman developed the initial concept of pedagogical content knowledge 27 years ago. His concern was that teachers view the need to teach subject matter separately from the way it needed to be taught. He combined these two domains of knowledge into pedagogical-content knowledge (PCK) (Shulman, 1986, 1987). Twenty years later, with the incremental increase in the use of technology in education, Mishra and Koehler (2006) expanded the model to integrate the third domain and created the technological-pedagogical-content knowledge (TPACK). This model provides a clear visual framework for practitioners to understand the knowledge required for effective integration of technology. TPACK is one form of highly practical knowledge that combines teachers' concurrent and interdependent curriculum content, general pedagogy and technological understanding (Harris & Hofer, 2009). Teacher education in many universities has utilised TPACK to evaluate programs and to pass on the knowledge of this framework to future teachers. The acronym 'TPACK' has captured the idea of a total package of elements (Borthwick, Charles, Pierson, Thompson, Park, Searson & Bull, 2008, p. 1) that can be used to assess the use of technology and its integration with pedagogy.

There are seven components that can be defined in the model. The next step in using the framework was to design an instrument to enable educational practitioners and researchers to examine teachers' perspectives on the different knowledge domains and the overlapping areas. A number of questionnaires were developed (Schmidt, Baran, Thompson, Koehler, Mishra & Shin, 2009; Archambault & Crippen, 2009) followed by a study on a USA sample of 596 K-12 online teachers using the designed questionnaire. The results suggest that "knowledge ratings are highest among the domains of pedagogy, content, and pedagogical content, indicating that responding online teachers felt very good about their knowledge related to these domains and were less confident when it comes to technology" (Archambault & Crippen, 2009, p. 71). The findings of this study also suggest a small correlation between technology and pedagogy domains, but a high correlation between content and pedagogical domains, emphasizing the need for further research and development in this area.

A different team of educational researchers (Schmidt, Baran, Thompson, Mishra, Koehler, & Shin, 2009) developed a checklist approach to examine the curriculum knowledge domains of pre-service teachers against the TPACK model. Harris, Grandgenett and Hoffer (nd) developed an assessment rubric through testing in K-12 education settings that can be used to review if a program had a "good" TPACK or how well the technology has been integrated in the areas of curriculum goals, instructional strategies, and the "fit" between all the knowledge domains. This process involved the development of the tool, feedback from TPACK experts and then the use of the tool by experienced teachers who used technology to assess the lesson plans of pre-service teachers. It was found that the instrument was reliable in assessing these planning documents (Harris et. al., nd).

In the Australian context, an education team developed the TPACK Confidence Survey (TCS) to look at the attitudes of teachers to the components of the TPACK (Albion, Proctor & Finger, 2010). In a longitudinal study of 35 beginning teachers, Bate (2010) examined how the teachers used information and communications technologies (ICTs) in the first three years of their teaching. Although they were able to clearly articulate their pedagogical beliefs that resonate with contemporary learning theory and operational ICT competence, they were unable to translate these pedagogical beliefs into practices that synergised pedagogical, content and technological knowledge (Bate & Maor, 2010). In 2012 a new design of the questionnaire not only attempted to analyse Vocational Educational and Training teachers' approach to integration of technology in TAFE colleges, but also conducted discriminant validity for TPACK construct (O'Brien, 2013).

The central issue of TPACK is related to the technology integration. However, to substantiate the research that examines the TPACK model, considerable theoretical work needs to take place to strengthen the field of educational technology. Graham (2011) argued that the research community that already engaged in research with TPACK had not done "the theoretical work required to make clear distinctions between model elements" (p. 1953). He critiqued the theoretical framework of TPACK and identified the following weaknesses in the model based on different research studies: lack of theoretical clarity, difficulties in establishing discrete and manageable categories that can be examined (Gess-Newsome, 2002), lack of specificity and lack of precise definitions (Angelie & Valanides, 2009), and unclear definitions of technology. For example, Cox (2008) found 89 different definitions for TPACK in the reviewed literature resulting in very few studies making a substantial contribution towards building a theoretical framework. Graham, also commented that "most instruments to date have not been able to establish an acceptable level of discriminant validity for TPACK construct" (2011, p. 1957). All these deficiencies require theoretical development for long-term viability of TPACK research.

Previously I have used TPACK as a general framework for the design and implementation of a master's level unit and to evaluate the unit. I analysed the activities implemented, the technologies used and the area of domain knowledge that the activities addressed (Maor & Roberts, 2011). The learning activities were addressing diversity and learning styles of the students based on Reading, Reflecting, Displaying and Doing, the R2D2 model (Bonk & Zhang, 2008). The Reading activities targeted the verbal and auditory learners, the Reflecting activities targeted the reflective and observational learners, the Displaying activities targeted the visual learners and the Doing activities targeted the "hands on learners".

Methodology

The participants in this study were 30 mostly postgraduate and a few undergraduate students (pre-service teachers, practicing teachers and school principals) enrolled in a degree in the School of Education in 2012. As the unit coordinator, I used a blended learning approach in an intensive, one-week, face-to-face classroom setting followed by three weeks of online group interactions. The content was e-learning, competency in the use of social learning tools and new technologies for teaching. A blended learning approach provides greater opportunities for diverse learning styles and stronger engagement. The R2D2 model within the context of TPACK was used to guide the selection of activities that emphasised interactivity, group work and collaboration. These attributes combined to characterise my *digital pedagogies*. The use of innovative pedagogies was examined by analysing students' responses in their ePortfolio, survey instruments and general feedback. I used TPACK as an analytical tool to examine students' reflections that provided feedback for further improvement. Through the students' work, I examined whether they understood the concept of digital pedagogies and how they were engaged with them. I wanted to know whether they appreciated the type of pedagogies I was trying to implement that included peer learning, interactive activities, the role of a discussion leader, and keeping a reflective journal. I facilitated the course in a way to make sure these attributes became embedded in the digital pedagogies.

I also reflected on my practice by using an action research design that incorporated qualitative methods and triangulation of different data sources, such as student artefacts, interviews with students, course feedback and the researcher journal. Students' reflections in their ePortfolio, their summaries of activities and online interactions created a rich data set for analysis and made the findings more credible. In this paper I review the way students reflected on the value of TPACK and R2D2 in the course and how they reacted to the implementation of my digital pedagogies.

Students' perceptions of the models/digital pedagogies introduced in the unit

In the following section, I illustrate examples of students' reflections about their engagement or disengagement with the elements that were introduced in the course from the 2012 intensive summer course cohort. Students had to take an active role in their learning during the week's face-to-face activities and during the one-month online interaction that followed. During this time, each group had to produce a project collaboratively. Students were assessed on: **creating an ePortfolio** using PebblePad to incorporate all the concepts, ideas and skills that they had learned in the unit using Web2.0 technologies, **a group presentation** on the use of the TPACK with a teaching scenario in a creative and authentic way, and **an online discussion** in which their contribution to others' learning to improve a teaching application was assessed.

Focus on pedagogy

The following excerpts illustrate that although the students perceived the value of the TPACK and R2D2 models as important frameworks for teaching, they also focused heavily on the pedagogy aspect of TPACK and other models:

We [our group] wanted our tool to be collaborative for the students, to utilise the R2D2 model explicitly, and to involve reflection by the students during the creation of their work. This meant that much of our focus was on the P[pedagogy] of TPACK, as we felt that the content could vary according to age groups, current projects and curriculum relevance, and that the technology itself was only one of many which could have been chosen to achieve the same learning goals.(StudentC, 2012)

Several of the participants have begun disseminating the model in their workplaces. For example, a school principal when elaborating on the effectiveness of the unit suggested that all models that were used in the unit might contribute to pedagogical improvement:

The notions of constructivism and connectivism as well as models such as TPACK, R2D2 and the 4Rs have enabled me to critically reflect upon the ways in which I integrate technology into the classroom, how I lead my staff to do this better and how I can improve my pedagogy in this area. (StudentA, 2012)

The activities in the unit provided opportunities to promote pedagogies which were not related to the technology. For example, in a non-technology activity, a set of cartoons was presented to identify the teacher, learner and learning. Students negotiated the meaning in groups and through this activity they had to identify their beliefs about teaching and learning. The impact of this low-tech, team-based activity challenged the students' critical thinking skills:

The cartoon activity that we completed on the first day of the intensive week has stuck in my mind ever since. I found this extremely thought-provoking as it really allowed us to dig deep into our understandings of pedagogies as well as the teaching and learning process. (StudentD, 2012)

Focus on collaboration

Students collaboratively edited their presentations to a stage where they felt they was greatly improved and included more details related to their spoken parts. *"Particularly, we endeavored to elaborate on the use of TPACK and R2D2, which I feel we successfully achieved."* (StudentB, 2012). The collaboration was further enhanced when the group had to consult with each other and produce the final "project" after an additional four weeks of online interactions. This resulted in a high level of collaborative learning using Web2.0 technologies. Online communities sharing ideas and challenging beliefs can encourage deeper reflection. And according to a student, the biggest benefit of the online collaboration was definitely the student interaction:

We were able to work together and brainstorm ideas about topics, give feedback, ask and answer questions as well as share resources. I found that I was consistently reflecting on other students' questions/answers, as well as my own, even subconsciously. (StudentB, 2012)

Teamwork was improved dramatically. One student, who is the head of her department, wrote about how this unit transformed her teaching practice:

The teacher's approach has provided me with a pedagogical model for my own context as a teacher of mature-age students and my students have benefitted because of this. (Student letter, 2011)

Another student expressed greater awareness about her own process of learning and how she had to adapt her ideas when working with the group:

In my experience, the fourth R [4R model], reconstructing, was not truly meaningful until I became involved in the group presentation. In that role, the amount of responsibility is correlated with a certain level of self-reflection and existing knowledge. You have to be willing to adapt and to own your part in any experience, even when things don't turn out as you wished. (StudentM, 2012)

The use of technology also challenged students to be creative in presenting their assignments in different formats within the PebblePad portfolio:

This is the start of my Webfolio in the Pebblepad Format. I have attached a video as I want to extend and challenge myself with using technology and Web 2.0 resources to structure my reflections and my educational journey. (StudentG, 2012)

The feedback in student surveys suggests an innovative approach, through diverse activities and collaborative learning, caused students to be engaged:

The teacher provided a good learning environment that enhanced collaborative learning...and challenged each other's thoughts and ideas. (StudentE, 2012)

The teacher cleverly probed deeper with questions that made us think harder during class discussions. (StudentG, 2012)

Students' responses suggest a high level of collaborative learning using Web2.0 technologies. They also identified that it was important to have a teacher who could challenge them to think harder about issues.

Focus on use of digital pedagogies

The students had different responses to the strong attempts to implement digital pedagogies. One of the students, a practicing teacher, suggested that she is already implementing her concept of a digital pedagogy in her school:

Since hearing this on the first day, I feel I have done just that. I am thinking outside the square and looking at things in a new light and sharing my ideas with others. I have so far done two mini PD's at work to demonstrate these new skills I have obtained and working together we are exploring and finding other things we can incorporate/blend technologies. I am LOVING IT! (StudentF, 2012)

As a final assessment task the students completed an ePortfolio in a PebblePad platform to demonstrate their learning throughout the unit. The ePortfolio requires integration of learning theories and the pedagogies being modeled. Students used digital artefacts and links to Web 2.0 resources to demonstrate their learning. The facilitator emphasised the high level of academic reflection she expected from students. Student feedback confirmed that this assessment task developed their knowledge in a practical way that they could apply in their further study and work as the following two examples illustrate:

This webfolio project has been a HUGE undertaking. This was a worthy undertaking and much of what I have learned will be transferred into my doctoral work. (StudentE, 2012)

Using the TPACK and R2D2 Models (which I have already got on my office wall) will form a major part of my work with staff over the coming months and has also honed my own thought processes for using technologies with my students. I feel my learning has definitely strengthened in these areas and this will continue into the future. (StudentA, 2012)

The facilitator constantly emphasized the value of digital pedagogies while demonstrating the use of the TPACK and R2D2 model. This consequently manifested in students' acknowledgment of the value of pedagogies. Two teachers wrote in their portfolio:

I feel that I have learned a lot from this unit and have an enhanced understanding of the pedagogies that underpin and provide a framework to integrate technologies best into the curriculum. Using some tools that I wouldn't have otherwise experienced has also been useful. Learning from others in the group through sharing and reflection of ideas, use of specific technologies, apps and tools was highly beneficial. (StudentA, 2012)

Great idea to have to put our assessments items within ePortfolio. I would never have understood how a webfolio can actually work, if I hadn't had the exposure through this unit. (Student, 2010)

Another two teachers understood the importance of the digital pedagogies as they expressed in their ePortfolio:

Well the R2D2 model, we have been working continuously within this model throughout our own learning of this unit. When I first started reading this book, I thought it had great ideas and was only thinking about it as a connection with the use of technology. I can see more clearly that isn't the case with this type of model. It offers the ability to enhance learning in any particular lesson; you just need to always question how to deliver this model [pedagogy]. (StudentJ, 2012)

I feel that the R2D2 and 4R models will (and have started to) transform my pedagogy as well as guide the conversations I have with my staff about meaningful integration of technologies into the curriculum. The R2D2 Model will particularly assist me in ensuring that students with different learning styles (diverse needs) have been catered for. (StudentD, 2012)

For several people the activities and the use of digital pedagogies provided stimulus for further learning and research. Analysis of the reflection in the initial PebblePad Webfolio showed that studentN presented some intriguing questions that actually encouraged her to extend her postgraduate research into this area:

I want to do more research into TPACK. Are all things created equal in terms of the three parts? I also want to spend some time reflecting on the accuracy and worth of the R2D2 model. I might look into how

these technology trends are affecting education in places like Africa, India and remote Australia. I want to look into peer assessment, having had a negative experience of it. I want to reflect on the potential negative side of all this technology - issues of screen time, entertaining the imagination right out of students, focus away from fundamentals (or are the fundamentals changing?), are community and relationships being rewritten. (StudentN, 2012)

There were also critical points of view and criticisms from students. A pre-service teacher didn't appreciate the less structured approach for the online task and also questioned the frameworks presented in relation to the practicality and real world he is going to face:

I like the use of online collaboration as a reflective tool; I feel that it would benefit from more specific direction or discussion topics.... How does TPACK relate to the National Curriculum Drive, How can TPACK assist in understanding MySchool? (StudentF, 2012).

One group of students in this unit felt like they were in a marathon. According to this group, the unit was intense, demanding and exhausting. They also thought the level of work demanded was very high. Other pre-service teachers were not impressed with the very intense nature of the course and with challenges for reflection and interaction with their peers that were presented. This, in some cases, created obstacles for understanding, thus, a few students did not engage with the digital pedagogies and did not collaborate with the other students. They were less committed to the interactive spirit of the class. How could a teacher get these students more engaged with digital pedagogies? Would relating the unit to some of the practical questions raised by Student F above, such as to the *National Curriculum* and to *MySchool* be one possible direction to take?

Overview of student perceptions

Overall the students found the unit to be very challenging. As they became more engaged in the unit, they could see the value for their own classroom practice and in particular the TPACK model. Some were motivated to turn the questions that arose during their learning experience into postgraduate research studies. Other commented on how they could use these pedagogical models to improve their classroom practice or enhance teachers' views on pedagogies. There were the few who remained on the periphery of the unit and did not engage with the interactive mode of the class. The diverse perceptions have a common core of new understanding of the integration of technology and pedagogy with the purpose of improving and creating new opportunities for learning.

Conclusion

Although this paper may read like a success story in the fact that the majority of students adopted digital pedagogies and implemented them in their classrooms, it also raised the question: Does this analysis help us to better understand the difficulties in implementing a complex e-learning environment that attempts to promote digital pedagogies? It became clear that there were difficulties for some students to engage with this type of environment. Thus, it means that further discussion is necessary to understand the nature of this concept and how to implement it successfully.

The concept of *digital pedagogies* describes the essence of teaching/facilitation in this unit. The unit was designed using digital resources and a sound pedagogy that engaged the learners in a technology-rich environment. It ensured curriculum relevance and used strategies that encouraged a collaborative educational experience, taking account of differences in learning styles. The excerpts from students demonstrated the spirit of the digital pedagogies that was facilitated through collaboration and peer learning. They also illustrated how the combined use of the TPACK and R2D2 models strengthened the concept of an integration of the different knowledge domains of pedagogy, technology and content. However, these models only provided us with a framework for teaching. They did not provide us with the interpretation, flexibility and creativity that required from a good teacher or from a "digital pedagogue" (Yaniv & Crichton, 2008). The collaborative nature of work that was created in this unit did not happen in a vacuum. It was created through the digital pedagogies that the facilitator built up and engaged students with during a challenging period of teaching. Therefore, currently we have learnt to address the new learning requirements of the 21st century in better way. We had the example of the principal that engaged his staff with the TPACK framework in a meaningful way, a primary school teacher who initiated a PD for colleagues and introduced innovative technologies and we have a postgraduate student who asks critical question in relation to research in this area and analysed it in her doctoral studies. But have we reached an optimal solution?

So, what opportunities and challenges await us? The concept of *digital pedagogies* will need further clarification in future research that focuses on the mindset and skills required for effective teaching and learning in our *digital* world with the rapid increase in the pace of technological innovation. This should also lead to a new form of professional development to promote a better understanding of the synergy between technology and pedagogy. Teachers will become “digital pedagogues” and have the ability to develop pedagogies that continue to evolve according to the needs of the students in a digital world.

By examining students’ reflections, they became participants in the scholarship of my own teaching practice. Students’ excerpts suggested a strong emphasis on communication and collaboration, which helped to create a community of practice. This was complemented by TPACK in the design and implementation of the unit with its strong emphasis on the integration of different knowledge domains. The synergy between pedagogy, technology and content area creates opportunities for digital pedagogies.

Learning from the past about the integration of technology, pedagogy and content knowledge can provide a good understanding of how to integrate technology into teaching while using constructivist pedagogies to utilize the technologies in appropriate ways to alleviate difficulties in teaching or learning content and concepts. This present understanding of the use of TPACK also paves the way for educators to engage students in collaborative learning and to develop the concept of *digital pedagogies*. Digital pedagogies may be the concept that can encompass all: teaching approach, students’ attitudes and desired learning outcomes. However, further research will be needed to establish that this is a good direction for the future.

So what comes next? The next stage is to refine the concept of digital pedagogies so that research can be implemented to see if its attributes enhance more critical and reflective learning. New models and more critical thinking about digital pedagogies are emerging all the time. For example a new model, such as the SMAR (Substitution, Augmentation, Modification and Substitution), might contribute to the discussion of improving 21st century learning. However, at this stage, we don’t fully understand the present so how can we imagine the future?

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