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Replies to commentaries on IDC Theory in practice

Tak-Wai Chan [1], Chee-Kit Looi [2] *, Su Luan Wong [3], Siu-Cheung Kong [4] and Ju-Ling Shih [1]

*Correspondence:
cheekit.looi@nie.edu.sg
National Institute of Education, Nanyang Technological University, 1 Nanyang Walk, Singapore, 637616, Singapore
Full list of author information is available at the end of the article

Abstract

We thank the seven scholars who have provided commentaries to our paper on the Interest-Driven Creator (IDC) experimental school in Taiwan. We provide replies to their commentaries in the interest of continuing the productive discussions that we hope to see in the further pursuance and refinement of the IDC theories. We also use the opportunity here to provide replies to the commentaries written by Dillenbourg et al. (2019) and Roschelle and Burke (2019), specifically written for the original IDC paper (Chan et al., 2018).

Situating IDC Theory in education — response to commentary by Dillenbourg et al.

Chee-Kit Looi

National Institute of Education, Nanyang Technological University, Singapore

Dillenbourg et al.'s (2019) stimulating commentary on the original IDC paper (Chan et al., 2018) structured their responses by posting six questions and providing their answers to these questions. In this response, we build on their insightful discussion and pose our responses to these questions.

Does IDC constitute a learning theory? Dillenbourg at el. presented three possible interpretations: as an explainable prediction, a conceptual framework and a political message. Yes, the IDC Theory does serve as a political message as it is a call for action for addressing the examination-driven culture touted to be prevalent in East Asia. It serves as a conceptual framework in the desire to serve as a model for educational transformation in response to the articulated education problems manifested in Asia. In this regard, we also note the perspective of Roschelle et al. (2019) using IDC as a leadership tool to engage

school and education leaders in postulating the future of education, both within and beyond their jurisdiction. The explainable prediction part of IDC (what will be the empirical outcomes of curriculum design and teaching and learning based on the IDC Theory) needs to be worked on in future research on IDC interventions.

Does education need yet another learning theory? We reaffirm that it is not just a learning theory per se, but a "macro-level" theory that synthesises many of the learning approaches, designs and theories that are already out there, but synthesising them in some coherent logic models, namely, the three loops of interest, creation and habit.

Will the digital revolution promote the adoption of IDC? We could not but agree fully. The future will be a digital edge where the context of learning, living and work will be a digitally pervasive society.

Is IDC threatened by learning analytics? This rests on the premise that the collection of learning behavioural and other data imposes constraints on learning tasks, for example, for now, it is still challenging to collect data that can be linked eventually to creativity. The premise has been criticised by Fisher et al. (2022) that we need to "measure what we value" and not fall prey to "value what we measure." The question motivates many research questions that might be studied to assess the learning activities related to the processes and outcomes produced by the IDC Theory.

Is IDC relevant to vocational education? We appreciate the relevance to vocational education from a European perspective. This prompts us to draw relevance of IDC Theory to higher education, adult and workforce learning, and, more broadly, life-long learning.

Is IDC enough? IDC Theory provides some of the ingredients needed for the transformation of the education system. A strong position is to argue that the principles behind the IDC Theory are necessary for educational transformation. We agree that more is needed, as in educational implementations of learning theories, other factors like classroom orchestration are also required to make it work in practice (Dillenbourg et al., 2019). By the same consideration, we also need critical success factors advocated in the educational change community, such as stakeholders' alignment and support, leadership, professional development, alignment and harmony in the education ecosystem, and other critical factors.

The IDC Theory is intended to serve as a trailblazer to highlight some of the important dimensions for the transformation of learning schools and to contribute to the conversation for innovations in education. Further refinement of the theory, articulation of the design principles, educational research, and empirical design and evaluations in diverse contexts, are all needed to continue to build up and improve the IDC Theory.

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IDC Theory as a model for future education and a leadership tool — response to commentary by Roschelle and Burke

Su Luan Wong [a], Ju-Ling Shih [b] and Tak-Wai Chan [b]

[a] Faculty of Educational Studies, Universiti Putra Malaysia, Malaysia

[b] National Central University, Taiwan

We could not agree more with Rochelle and Burke (2019) that the crux of IDC Theory (Chan et al., 2018) is on the agency of learners — they pursue their learning driven by interest where they make their own choices, voice opinions and ask questions. Given that students must be prepared to face a volatile, uncertain, complex and ambiguous (VUCA) world, learning must go beyond mere knowledge acquisition. Inevitably, students must build the agency and capabilities to create personal ideas and creative artefacts driven by their interest. IDC Theory posits that much of the learning process occurs in the creation loop. Ideas are generated when learning occurs — tangible artefacts may be produced too. At the same time, students learn through ideas and artefacts creation. We, therefore, regard learning as a creation process and vice versa. For this reason, it makes sense that the actual learning process occurs during creation (Chan et al., 2019). Roschelle and Burke (2019) aptly describe that for learning to occur, educators must first cater to student interest as launching points for student-centred learning that will augment students to immerse more profoundly in their interest.

We also share Roschelle and Burke's opinion that focusing on creation and creativity is essential for learning — creativity is a creation process, but creation does not equate to creativity. Nevertheless, the creation process can develop the habits of creativity. The combining stage in the creation loop underlies creativity and creation. In IDC context, we contend that students will refer to existing ideas or artefacts to create newer ideas or artefacts that are useful to them (Chan, 2019). In a broader context, creativity encompasses creating something unique, innovative or original — the creation has to be useful or valuable to a relevant community. Roschelle and Burke's aptly captured the synergy between creation and creativity when they said that "celebrating the creations breathes energy into habit of creativity; cultivating creativity regularly leads to more authentic and meaningful creations" (p.5).

Roschelle and Burke point out that habit is the most intriguing loop. This is true because the habit of learning strongly influences students' learning and performance. When students acquire the habit of learning in IDC context, they do not require conscious effort to learn — learning becomes second nature to them. To thrive in the VUCA world and particularly when the world is moving from the COVID-19 pandemic to the endemic stage, students must possess lifelong learning habits—where they can learn, un-learn, re-learn,

co-learn and eventually co-create creatively. Indeed, harmony is an essential outcome of learning habit because students relish the sense of satisfaction and experience inner peace. Given the repeated pleasant feelings of harmony, students would strive to pursue the routine activities. Through the lens of IDC Theory, students are nurtured to become lifelong interest-driven creators. However, Chen et al. (2020) stress that building a habit of creation takes a considerable amount of time.

Besides being a learning design theory, IDC Theory can serve as a leadership tool, as proposed in Roschelle and Burke's commentary. A future education model can be crucial for transforming education in a school area, a region, or a country. The reason is simple: to see, to feel, to change — these sub processes, when educators encounter a tangible model, will effectively initiate and drive them to change (Kotter & Cohen, 2012). This is the power of imitation. The word 'imitation' here does not mean copying or replicating but aligns with the imitation component in the creation loop of IDC Theory. It means that innovations and new features of an IDC educational model will inspire educators to 'combine' what they are seeing with what they have known before and develop ideas to change.

As described in the paper, the IDC experimental school intends to serve as a model of future education in Taiwan. To develop other IDC educational model sites, besides being a brand new school, it can start with a few classes in the early grades of an existing school and proceed for years. With collaboration among international researchers, it is possible to form a network of IDC educational models from different regions and countries in Asia and the world. The idea of such a global collaborative endeavour was expounded when seamless learning concept and component exchange framework were introduced (Chan et al., 2006; Deng et al., 2006). Nevertheless, if such a network of IDC models can seamlessly connect and support each other efficaciously, it will become a global leader in transforming education.

IDC Theory as a leadership tool functions like a drive wheel of the big educational system:

1. IDC Theory as the theoretical infrastructure. IDC Theory can be applied not only in primary and secondary education, but also in higher education. Higher education in the United States regards students' non-academic performances, especially those that demonstrate students' special interests, as an important part of their college entrance admissions. IDC Theory as the theoretical infrastructure emphasises the extension of learning with interests from childhood to lifelong learning. IDC Theory can instigate children's desire and strengthen their dexterity to grow towards the complex future. The work is transformational;
2. IDC Theory as the initiative of change. IDC Theory is oriented from Asia to balance test-oriented education. Its scope can be broadened to the countries beyond Asia to assist in guiding educational configurations that need opportunities to boost students' autonomy, search for individual interests and nurture expertise, and reveal students'

creative potentials. IDC Theory can lead the initiative to make the pedagogical conceptual change. The reach is global;

3. IDC Theory as a manifesto for future education. IDC Theory can be used as the premise of a paradigm shift from test-oriented education to interest-driven education. It works as the core, aim, and guidance of the discourse for educational reform and policy making, especially in Asia. The dialogue is reflexive with the international intellectual collaborative power, and the evolution is progressive.

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Translating IDC Theory into action — response to commentary by Wong

Tak-Wai Chan

National Central University, Taiwan

A theory gives us a direction on how to design for future education. Translating the theory into real-world practice will take years of effort. There is no best design, but better design. What is more important is to undertake numerous cycles of design, experiment, and reflection, aiming to progress in transforming our education. The theory is constantly revised in this continuous improvement process, and some parts of the theory are refuted. More than 2,500 years ago, Confucius said: "Teach according to the student's ability." Today, to realise his dream, even though momentous advancement has been achieved, we still endeavour. More than a century ago, Dewey and Dewey (1915) wrote: "… the ordinary school impressed the little one into a narrow area, into a melancholy silence, into a forced attitude of mind and body" (pp. 18-20). Today, this is still valid in most Asian schools, where their education is still very much examination-driven (Chan et al., 2018). An all-important goal of IDC Theory is to evocate balanced attention to both the learning process and learning performance, including high-stake examination performance, instead of teaching only to get better examination results. It will take decades to prove this is a feasible goal. Nevertheless, teachers, parents, and researchers are satisfied with students' academic performance. Almost all students enjoy their learning in schools, even though the experimental school has just begun operating a few years ago.

Wong expects a precise translation of IDC Theory into the design of learning activities. Reading and writing are well-aligned with IDC Theory because the theory was inspired by reading and writing experiments several years ago (Chan et al., 2018; Wang et al., 2014). However, we are only at the beginning of this process for other subjects, but Wong's expectation seems too optimistic, if not too high. For example, Wong says, "Most of the section (section 5) is dedicated to elaborating how the creation loop is enacted through various learning tasks in individual subjects. Contrarily, the interest loop, albeit cited in the implementation of all subjects, is generally reduced to its creation-triggering role in exposition …". To a large extent, this is true. Not much emphasis on interest development in the design has been addressed in the paper. However, this is understandable because, in IDC Theory, the learning process is viewed as a creation process consisting of *imitating*, *combining*, and *staging* as creation components (Chan et al., 2019). In other words, a learning task can be divided into these three component tasks. Thus, based on the nature of the learning task (e.g., different subjects having different underlying principles), how to design these components properly becomes the first level of design. Interest is the second level of design: enhancing the design so that students' interest in every component of the

learning task is further developed. However, in most cases, during the first-level design process, the second-level design has been implicitly included. Therefore, Wong's presumption is correct: "… the intangible interest development process might ensue along with the tangible creation activities."

It should be noted that several researchers found that students' engagement and learning performance are elevated after the first level of design (Huang et al., 2020; Kong & Wang, 2019; Kong et al., 2018; Zheng et al., 2021). Notwithstanding this result, we expect that the design and performance will be significantly further improved if the second level design—interest development design—proceeds rigorously after some trials in practice. The reading design Modelled Sustained Silent Reading (MSSR), which has been studied for more than a decade, demonstrates that most students have developed individual interest besides establishing reading habit in school and at home. Many bring books along when shopping or eating in restaurants with their parents. For writing, the same phenomenon happens to some students also.

Habit is the third level of design (Chan et al., 2018; Chen et al., 2020). Wong needs to grasp the role of habit in IDC Theory. He said: "… advancing to the habit loop as the ultimate IDC state may remain as an idealistic advocate until the IDC researchers or practitioners attain an in-depth understanding of how to operationalise it in school contexts."

Our response to his comment is: First, interest development needs habit. Only by repeatedly carrying out the creation activities designed for a domain can students develop interest of the domain, from situational to individual interest. Second, building good habits is the essence of all education. Behaviour is a habit. Attitude is a habit. Acquiring abundant knowledge of a domain needs time, repeated engagement, and accumulation of what has been learnt about the domain, and this is also a habit. By the same token, a student who is good at how to learn must have built a habit of how to learn well. Third, the school is a particular place to develop habits of learning. Unlike many other experiments, the experimental school does not conduct experiments for just a week or a month but for years. To design a curriculum means to design various learning activities of a domain enacted as the school's routines. Schooling, by and large, is practising a set of habits. Thus, even though the design of a learning activity is suboptimal in terms of creation or interest development (hence requires endless refinement), considering how to form a habit of the activity must be included.

More than 2,500 years ago, Confucius stated his dream in education: "Teach according to the student's ability." Today we still strive to realise his dream. IDC Theory states: "Teach by nurturing the student's interest." Like Confucius' dream, attaining IDC Theory's goal will entail many years of incessant and collective endeavours of researchers and practitioners. In the process, there is no best practice, but better practice. This is a journey which never ends.

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IDC as a holistic learning design theory — response to commentaries by Xie and Khambari

Su Luan Wong

Faculty of Educational Studies, Universiti Putra Malaysia, Malaysia

In response to Xie's view that IDC Theory is an instructional theory, we instead view it as a holistic learning design theory that descriptively explains the learning process. The tenets of IDC Theory resonate with Harasim's (2017) definition of a learning theory — it helps teachers to understand how learning occurs and how people learn. IDC Theory gives ideas on how people learn and not how people should teach. It does not prescribe how instruction should be structured to promote interest in learning, knowledge creation, and habit formation.

Ideally, IDC Theory can be used to form the foundation for designing learning activities with the following assumptions:

1. Learning is aligned with the learner's interest;
2. Learning activities are developed as interest-driven creation activities;
3. Interest-driven creation activities are embedded into students' daily routines to form habits of learning.

Assuming the aforementioned assumptions are met, we can expect the following favourable outcomes:

1. Students will enjoy learning;
2. Students will be curious to acquire new knowledge and skills;
3. Students will strive to learn more with lesser effort;
4. Students will perform better and be ready for high-stakes testing;
5. Students will acquire 21st century competences to be habitual lifelong learners.

We agree with Xie that IDC-related constructs and variables should be operationalised to create valid and reliable measures to ensure the theory's effectiveness. We contend that more in-depth empirical studies are needed to identify and concretise significant characteristics of the interest (triggering-immersing-extending), creation (imitating-combining-staging) and habit loops (cuing environment-routine-harmony). We acknowledge that current empirical shreds of evidence emanate primarily from school and tertiary settings revolving around the Asian region, particularly Taiwan, Hong Kong, Singapore and Malaysia. This inhibits the generalisability of the theory's effectiveness beyond Asia. One way to address this concern is we are resolute in our determination to establish a Global IDC Foundation with the main aim of conducting and disseminating evidence from authentic learning environments. The foundation also aims to attract more IDC researchers from other parts of the world to collaborate with us.

Understanding IDC Theory has made it possible for practitioners to make informed decisions about choosing the appropriate instructional practices and tools for meaningful learning (Khambari, 2019; Kong & Wang, 2019; Wong & Wong, 2019). Khambari's commentary is a case in point — using IDC Theory as an anchor in designing hands-on sessions, she showcased how the IDC tenets are cultivated in a teacher education program. Her deep understanding of IDC Theory led her to design the ePortfolio writing activities for the practical sessions of a compulsory Educational Technology course. By piquing her students' interest in using ePortfolio to express their thoughts and emotions, students started to immerse themselves in composing their ePortfolio about their teaching and learning experiences gained throughout the 14-week course. The students were engaged in creating knowledge through their involvement in reflective practice, which is repeated every week, thus forming creation habits. We anticipate that exposing the students explicitly to the fundamentals of IDC Theory — learning about the theory as part of the course syllabus during lectures would ensure they internalise IDC Theory when they teach in the actual classrooms. Once their understanding of IDC Theory is fortified at the teacher preparatory level, student teachers who transition to school teachers will design IDC-driven learning activities in their teaching practices volitionally and without much effort. Her work shows that teachers can be trained to pique students' interest in learning, create situations that are apt for meaningful creation and support the formation of good habits. Khambari utilized IDC Theory to understand how her students learn best. She effectively determined the right teaching strategies integrated with a simple technological tool to achieve the course learning outcomes. Clearly, the aforesaid description bears the hallmark of how a learning design theory works for educators.

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Enlighten smiles with IDC endeavour — response to commentaries by Mason and Chen

Ju-Ling Shih

National Central University, Taiwan

In the past three years, I have participated in the IDC school establishment, administrative management, social science curriculum design, and teacher training. I have seen IDC Theory in practice in several aspects that correspond to the comments of Mason and Chen which require vision and collaborative endeavour of all stakeholders, especially the teachers and parents. The outcome of IDC education is encouraging — highly performing students with smiles and confidence in the school.

Paradigm shift from knowledge to interest

Parental support and acknowledgement of the paradigm shift from test-driven teaching to interest-driven learning, which placed its emphasis on literacy, value, and character building. As Chen mentions, we are in a VUCA era of technology, interconnectedness, and interdisciplinarity. Thereafter, students' relations with Self, Others, Society, Nature Environment, and Artificial Environment are established throughout the theme-based curriculum. In the IDC School, themes are designed across subjects, so collaborative teaching is encouraged among teachers. The scope of interdisciplinary studies is well positioned to tackle the real-world characteristic of 'Double E' problems. Therefore, in daily classrooms, students are led to read, write, work on tasks, and experience theme-based activities instead of having lectures and tests. Parents are invited to give classes about jobs, cultures, and expertise, establishing close relationships with kids with love and care. Thus, students' cognitive, social, physical and psychological development are attended to in a well-round manner.

Creation as a process and outcome

As Mason mentions several student-driven inquiry models, IDC Theory regards learning as a form of creation through self-initiated inquiry. It is worth noting that students shall share not only their completed works and those that are done well but also those works-in-progress or fair products. Since creation is regarded as the outcome and the process, all works done with effort are worth sharing. Even projects that could be done better should be shared so that students learn from failures. Including productive failures in learning is an important part of the spirit.

Technology as an agent and companion

Mason nicely describes IDC Theory as an excellent example of repositioning human agency in learning. Students take the initiative in learning with their teachers' and parents' support and guidance. Now, technology has become the third hand that provides digital support to students. Technology is no longer just a tool for learning that assist word processing, graphic design, statistical analysis, looking up information, and so forth. Technology, including computers, mobile devices, robots, and other computational systems, are learning agents that function as students' representative figures to perform autonomous, reactive, proactive and interactive behaviours with others. With artificial intelligence, technology further acts as a learning companion that provides customised and student-centred support. For example, IDC has a corresponding platform School of Tomorrow, that provides self-directed resources for reading, writing, mathematics, etc., with smart agent as students' learning companions. With that, seamless learning environment that connects schools, homes, and individual time is equipped with rich and meaningful resources. It supports active, productive, creative, and collaborative learning (Chan et al., 2006).

More than a cultural thing

Concurring with Chen's view, IDC Theory started in Asia and has spread to other countries/regions in a broader context to sustain more grades, subjects, and schools. It is more than a cultural thing, but entails a learning culture that is sustainable in educational settings beyond Asia. Chen describes that the IDC initiative could do more with several drivers of change, including "enhancing the quality and effectiveness of the innovation, the extent to which the innovation is maintained in ongoing use, the extent to which large numbers of people or organisations, adopt an innovation a decentralisation of ownership over the creation of an innovation, and learning from adopters by the original creators of an innovation". Large-scale technological and pedagogical innovation can be achieved with international collaborations by combining complementary strengths and insights (Chan et al., 2006; Deng et al., 2006). Only through converging theories and practices on testbeds across cultures can IDC effects be seen through multi-perspectives, multi-modal, and multi-dimensional research and analysis.

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Reshaping school education through IDC Theory — response to commentaries by Kinshuk and Hayashi

Siu-Cheung Kong

Education University of Hong Kong, Hong Kong

Kinshuk and Hayashi point out an important rationale behind the blueprint for educational transformation in school education sectors — there is a reciprocal relationship when the society builds schools to nurture students who are capable to meet the demands in the future society; and schools create society of which the school community is reshaping its desire and scope. Our experiment was indeed motivated by this rationale — with an attempt to contribute to reshaping elementary school education for meeting the needs as well as navigating the development of the future society in the digital era. We thank Kinshuk and Hayashi for recognising our experiment as a successful attempt at transplanting an alternative pedagogy into the school education system in Asia — specifically Taiwan. We did synchronise international reforms in school education sectors — a promising approach also emphasised by Kinshuk and Hayashi — when we experimented with establishing the IDC School in Taiwan to address the limitation of existing examination-driven culture in Asian education systems. We have made year-long efforts to deeply reflect on the trends of reforms in the international school education community; we attentively identify the gap between the existing strengths and weaknesses of the local school education system in Taiwan and the expectations for future education in the school education context around the world. We also prudently plan for feasible ways to synchronise the promising ideas for Taiwanese elementary schools to make educational transformation for future education in the local context.

We agree with Kinshuk and Hayashi that we have gained insights from the West. The future society in the 21st century greatly demands citizens who demonstrate a high level of creativity; and at the same time recognised challenges in the Asian context that the curriculum delivery in education systems inadequately engage students in the development of creativity through schooling activities. We have realised that students' interest triggers their development of creativity; while interest needs to be maintained for a period of time for building habits and developing creativity in day-to-day learning. It is challenging for young elementary school students — especially Asian students who are typically hard-working in study works yet tense about examination achievements — to be motivated and sustainable in the interest-habit-creativity development through schooling activities. Kinshuk is observant to note that our experiment rode on the change in the governmental policy on operating experimental education models in Taiwan. Hayashi looks into our experiment to discern an interesting and noteworthy Asian-style of policy transfer model

for educational innovations in school education sectors — the initiative of school-wide implementation of IDC curriculum (i.e., the establishment of IDC School) is officially approved by the local educational authority (i.e., the Taiwanese government). Both scholars point out the need to further investigate this manner for educational transformation.

We acknowledge and appreciate the insights from Kinshuk and Hayashi into implementing multiple optimal solutions for policy implementation in school education. As articulated in the section "Implementation of IDC beyond Taiwan" in our position paper, we expand IDC-like implementations in varying education sectors in other Asian countries and regions such as Hong Kong, Malaysia, and Singapore. Our partners in these Asian countries and regions apply IDC Theory in line with the educational policy emphases in their local context. As our articulation of the case in Hong Kong, the IDC-like implementation addresses the policy concern of Hong Kong's government on promoting STEM education in primary education sector. At the same time, it takes a disruptive approach which matches the individual needs of different participating schools in day-to-day curriculum to trigger students' interest in coding, and their habitual thinking and practice of coding for apps creation. As partners in Hong Kong (Kong et al., 2018) report, this IDC initiative can innovate the pedagogy "To Play, To Think, To Code" and successfully support students to develop interest in apps creation through enjoying game-apps playing. Students then experience the process and build the habit of coding apps through the year-long coding course, and then develop and demonstrate creativity in apps creation through the course-specific coding project.

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Abbreviations

IDC: Interest-Driven Creator; VUCA: Volatile, uncertain, complex and ambiguous.

Authors' contributions

All authors collaborated to write the manuscript, make revisions, and to read and approve the final manuscript.

Authors' information

[1] Graduate Institute of Network Learning Technology, National Central University, Taiwan

[2] National Institute of Education, Nanyang Technological University, Singapore

[3] Faculty of Educational Studies, Universiti Putra Malaysia, Malaysia

[4] Department of Mathematics and Information Technology, The Education University of Hong Kong, Hong Kong

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