Design thinking as a medium of professionalism and learning: A case of business incubator

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Abstract: This article is a case study that explores the understanding of design thinking strategies undertaken by final year students in the field of design and architecture in Business Incubator (BI) projects. The BI project is developed by the university with its partners or by students themselves with the determination that the project still provides a potential effect on BI. Many previous studies have been developed with reference to how Business Incubators (BIs) benefit students and contribute successfully to a developing country. The present study aims at investigating the university students’ perspective as BI’s executors who are required to remain professional while maintaining the importance of BI implementation in their university. Additionally, the uniqueness of the present study is that the design thinking approach used in the project provides also scientific enrichment in design methods. Furthermore, such an approach is universal and flexible in helping students who are still studying but they are required to be professional in running the project. We can figure out the shift in the use of this design thinking method when it is run by new learners in a real project world, not in a simulation studio.

Subjects: Collaborative Design; Strategic Management; Visual Arts; Design

Keywords: design; architecture; business; incubators; strategic; thinking

1. Introduction

Business incubators are very important and necessary, especially in the developing world today. Business incubator (BI) is among the various initiatives that stimulates and supports economic
growth by promoting the creation and development of innovative companies (Al-Mubaraki, Muhammad, & Busler, 2015; Jamil et al., 2016; Mubaraki & Busler, 2015).

In Indonesia, for instance, BI is developed based on the initiation of a government program which is then encouraged to be implemented at the university level. Accordingly, Higher education plays an important role in empowering and creating an entrepreneurial environment for the students and even facilitating a provider of business involving students (Trivedi, 2016). The Indonesian Ministry of Research, Technology and Higher Education expects this BI program to provide students' work experience and foster an applied university research culture with a commercial basis. Thus, universities play an important role in updating their business model that is no longer oriented to the curriculum and research results separately, rather they should become a unified part (Tian & Martin, 2014). At least, a good practice of this BI project is that students who carry out training projects, internships and final assignments can be involved to improve their ability in solving concrete problems provided by the university with their partners before they actually go to the field (Gao & Orr, 2015).

The spirit of BI managed by the university should be maintained and needs to be supported by high professionalism of project executives as well. However, professionalism becomes very contradictory when it must be encountered by students who are still in the context of learning. Ultimately, the university as a provider puts its trust in the project and encourages students to trust such a project that the Business Incubator (BI) project is a medium for them to put hope that brings them the common interest (Suntornpithug & Todorovic, 2015). Meanwhile, with the regard to their role, the students must be able to play a dual roles (Low, 2015), i.e. as a learner and a project executor. The next important need is to what extent this professionalism could suit their level of understanding in solving the problems of BI project.

BI's success with the story of its executors has been described and reported by some previous studies (Al-Mubaraki et al., 2015; Gao & Orr, 2015; Suntornpithug & Todorovic, 2015). However, what if the approach of professionalism on the work of BI by the students is done with tools that are universal and very powerful as a problem solving. The present study provides a review of Business Incubator (BI) by proposing a suitable approach of design thinking strategy. Why Design Thinking? Design thinking has become a useful paradigm in solving many problems in various fields and placed such a strategy as a universal methodology in all cases (Gobble, 2014; Sahay, 2014; Watson, 2015). Gobble (2014) asserted that since the appearance of design thinking in Brown’s articles (2009; 2010), this method has been described as a human-centered approach to problem solving.

Innovators use design thinking to move through three general phases: During “inspiration,” they experience a “problem or opportunity” that sets them in motion; during “ideation,” they generate and test ideas; and during “implementation,” they move their innovation “from the project room to the market.” Products may cycle through these steps more than once. (Brown, 2009)

In its development, design thinking has become a method that requires a deep understanding to the context of the problems encountered, specially, human-centered context (Suprobo, 2012). Likewise, it also acts as means that accelerate innovation and penetrate organizational boundaries (Cleary, 2015; Ketter, 2016; Watson, 2015). The point is that such an approach is capable of confronting obstacles to being able to produce: from “what is” to “what works” (Liedtka, 2014). That is why design thinking approach plays an important role as a medium to reduce the gap between student professionalism as BI’s executor of the project and learner as a student of higher education. Based on the aforementioned cases, The central questions to be investigated in the present study are (1) How do students as novice designers undergo potentially BI projects with Design Thinking approach? (2) How do these novice designers feel and accept a new understanding of design thinking in the context of BI?; (3) What are the themes of responses and theoretical ideas that can help to understand the case?
In this case study, the main focus of research is to figure out the problems with reference to design thinking approach in a BI project carried out by the novice designers i.e. university students. Additionally, it aims to also describe the approach of design thinking strategy from the perspective of the perpetrators, namely the final students involved in the concrete projects or potentially as Business Incubator projects.

2. Research design
To understand the beliefs of students involved in this Potential Business Incubator project, a methodology is needed to allow them to express their ideas in depth and lead us to react to their ideas with appropriate follow-up questions. To understand participants’ behavior and the meaning of this behavior requires researchers to examine the complexities of their lives in the studio and collect data that will give a rich description of the actions of participants with their colleagues, mentors, and expert partners. In order to investigate their views on a defined project goal, access to the documents they log book is required. With such a contextual detail, the present study uses a case study approach as recommended by Thomas (2015) and Yin (2013). Three main data sources are used: (1) in-depth interviews with participants, (2) observations of their work processes, and (3) other written or pictorial documents.

2.1. Participants
Participants are students at the end semester of the course for design and architecture degree studies in Surabaya City, Indonesia. Three participants from the architecture studies program focus on regional development projects. They are Erly as the fifth participant (P5), Yongky as the eighth participant (P8), and Megawati as the ninth participant (P9). The other seven participants of the interior design study program are divided into six participants focusing on product design and one on space issues. They are Dendy as the first participant (P1), Stella as the second participant (P2), Olin as the third participant (P3), Grace as the fourth participant (P4), Jessica as the sixth participant (P6), Gani as the seventh participant (P7) and Yiawla as the tenth participant (P10). The complete description of the study program’s origin and type of project done by the participants can be seen in Table 1.

The BI projects established by the university with clients/partners were initially offered to students who prepare for their final project. In this case study, participants who took up the regional development project was a project of the Business Incubator (BI). Meanwhile, the other seven participants took the initiative to propose the project but with a fixed-oriented BI project that has great potential to be applied in both community and industry markets.

2.2. Procedure & analysis
Data were collected from the early March 2017 to the next six months. The approach taken during the process was the observation of behavior and work, interviewing and communicating intensively to figure out what they feel. In-depth data collection for the present study began to really take place in last the sixth months with the basic consideration that they have gone through all phases of the design process so as to provide an in-depth description of what and how they experienced all the design thinking process. The results of observation, interviews, documentation of their work or artifacts and field notes became the primary strategy in collecting this data.

The analysis used was initiated by reading all the texts and documents obtained following the initial code. Next, understanding the case at hand and starting mapping the existing code and classify it into themes that support the contextual case at hand. The development of the naturalistic generalization of the lessons learned can eventually be described and presented in the form of a supportive diagram (Creswell & Poth, 2017; Yin, 2013).

To ensure validity and reliability of the study, agreement on the results of interview transcripts and interpretations between researchers and participants provided strong evidence of the validity. This was also supported by the use of several methods of collecting data derived from various sources and analysis of data that were composed by the code which became the theme that has been done
| Participant name & code | Study program | Scope of project |
|-------------------------|---------------|------------------|
| Dendy-P1                | Interior Product Design | • The design of multifunctional furniture set for café  
• It can add productivity and the needs of users who come to Zybrick Coffee  
• This furniture supports the user café with the activity not only enjoying coffee, but also doing other activities (doing tasks, networking, playing, etc.) |
| Stella-P2               | Interior Product Design | • The design of furniture sets for family activities in residential areas  
• It is a blueprint design that aims to accommodate complex user activities in the family room  
• It makes the alternative idea on the market to solve the existing problems in the family room on the narrow residential |
| Olin-P3                 | Interior Design & Styling | • Interior Design of Dolanan (Game Edutainment) for Children 4–12 years old  
• The design of this interior as a blueprint that aims to accommodate the entertainment and educational facilities for children in Surabaya  
• It is packed with modern and distinctive concept of local culture of East Java, namely “Dolanan” |
| Grace-P4                | Interior Design & Styling | • Break-time Space for elementary school  
• It is a break area that can be used as a place to interact, play and lunch  
• The design reduces the social gap among students of Catholic Elementary School of St. Carolus in Surabaya so that the interaction of students with colleagues and the environment can be more leverage |
| Erly-P5                 | Architecture     | • Spatial Study of Heritage Tourism and Preservation of Old Town Site Surabaya  
• It is a cooperation project developed by Widyakartika’s Industrial Design and Built Environment Center (Pusdewika)  
• This design intends to develop corridor segment area in Surabaya, namely Petekan Bridge—Merah Bridge to be the positive historical area |
| Jessica-P6              | Interior Product Design | • Modular Furniture for Exhibition of Student Design Work  
• This furniture design is present to facilitate the exhibition done with short preparation and organizing by the students and Interior Design Department of Petra Christian University  
• This design accommodates the feasibility, functional and practical value of the needs of various products presented |
| Gani-P7                 | Interior Product Design | • Design of Multifunction Furniture for Relaxation in Villa Area  
• The design accommodates the human needs for rest, namely relaxation  
• The study include the materials, esthetics of furniture, and detailed ergonomic dimension to support comfort in use  
• The target location of the object is in the hilly area of Villa Grand Trawas Mojokerto, East Java |
| Yongky-P8               | Architecture     | • The Prospect and Spatial Challenges of Trade and Service Areas on the waterfront of the Kalimas River at Surabaya  
• It is a cooperation project developed by Widyakartika’s Industrial Design and Built Environment Center (Pusdewika)  
• This design intends to develop corridor segment area in Surabaya, namely Jagalan Bridge—Bridge Ambengan to be the center of trade and service oriented sustainability |
| Megawati-P9             | Architecture     | • Open Space & Water Tourism: A Proposed Design Kalimas River Area on corridor of BAT bridge—Wonokromo Bridge at Surabaya  
• It is a cooperation project developed by Widyakartika’s Industrial Design and Built Environment Center (Pusdewika)  
• This design intends to develop corridor segment area in Surabaya, namely BAT Bridge—Wonokromo Bridge to be the main attraction of both local and foreign communities and as a distinctive feature of the area in Surabaya City |
| Yiawla-P10              | Interior Product Design | • Implementation of Traditional Games on Interior Elements of Kindergarten Schools  
• Design object is the product of interior elements for children which in addition serves to accommodate the learning activities as well as a means of playing while learning through the implementation of traditional games on the interior elements  
• The project targets are Kindergarten of Kuncup Bunga Sidoarjo, Kindergarten of Cendekia 1, and Kindergarten of Santa Maria Sidoarjo |
in a structured, especially assisted by tools RQDA (Chandra & Shang, 2017; Ronggui, 2016) which is specific to this type of qualitative research. RQDA facilitates file storage of interviews, encoding, category creation, and project management. We use this software to include transcript files of interviews and notes, codes, categories or themes, and memos. This tool is effective enough to map out concepts or themes based on code that are essentially insightful of the many interview data and records that have been collected.

Furthermore, this validity has also been tested through long-term observations in which the results were examined by colleagues. Meanwhile, the researcher’s biased influence can be reduced through theoretically oriented descriptive considerations.

3. The project process of business incubator

The process of project work undertaken by students becomes fully the responsibility of the students to complete it based on agreed targets among students, clients, mentors, and universities as business incubator holders. The University as an education provider is required to organize the monitoring phase during this final project. Stages of monitoring the learning is divided into the stage of inspiration or programming, ideation stage or schematic and implementation phase. An overview of the learning monitoring stages related to the business incubator projects that students run can be seen in Table 2 and Figures 1–3.

4. Finding

What students do, feel, and receive as designers of these projects can be mapped into 7 (seven) themes arranged in three major schemes, (1) what they actually do, (2) what they feel and get and, (3) what obstacles they face.

With regard to what they have been doing, these students basically run three important activities which are comprised into three themes: (1) getting inspired and exploring problems; (2) defining design requirements and adjustments to user needs; (3) designing development and problem solving. Additionally, in running all these activities, there are things that become guidelines and always present in their activities. They act as a working principle to make all their activities work well. This constitutes the fourth theme in the present study. These principles include (1) feel as an user; (2) collaborate with colleagues; (3) enjoy the work process; (4) consult with mentors from various disciplines intensively; and (5) force yourself to always be passionate in study and work for optimal design results.

With reference to what the students feel and gain, they experience what is known as early stage learning which is quite understood as new experiences. Furthermore, they are at a more difficult level that is to make their abstract thinking patterns to be concrete in a design formula that the user needs. The next experience is called the next stage of learning. Both of these learning stages are the two themes that the students acquire in proceeding in this project with a design thinking approach.

| Table 2. The monitoring stage of learning for project of business incubator based on design thinking |
|-----------------------------------------------|
| Monitoring stage of learning                |
| Stage of Inspiration/Programming           |
| At this stage, the university monitors and evaluates project outcomes as follows: |
| • Data on exploration results (field observation, literature study, typology studies & in-depth interviews) |
| • Data Analysis (Programming)               |
| • Programmatic Concept and Framework        |
| Stage of Ideation/Schematic                 |
| At this stage, the university monitors and evaluates project outcomes as follows: |
| • Design Concept                            |
| • Sketsa Konseptual                         |
| • Prototype Study (User Feedback)           |
| • Construction Drawing                      |
| • Presentation Drawing                      |
| Stage of implementation                     |
| At this stage, the university monitors and evaluates project outcomes according to the needs of the client and BI’s Holder as follows: |
| • Design Report                             |
| • Publication in Journal                    |
| • Business Model                            |
| • Final Prototype                           |
| • Video (User Feedback, Demonstrasi)        |
All stages have been done well with final outcomes including reports, journal publications, prototypes, and video documentation of user responses.

Figure 1. The process of design project conducted by Participant 2.
The Prospect and Spatial Challenges of Trade and Service Areas on the waterfront of the Kalimas River at

By Yongky-P8 Surabaya

Figure 2. The process of design project conducted by Participant 8.

All stages have been done well with the final results including reports, journal publications, study models, and potential user responses through seminar.
Implementation of Traditional Games on Interior Elements of Kindergarten Schools

By Yiawla-P10

All stages have been done well with final outcomes including reports, journal publications, prototypes, and video documentation of user responses.

Figure 3. The process of design project conducted by Participant 10.
Among all that has been done and experienced by the students, they also encountered some constraints experienced during the process. Those obstacles are internal and external constraints. Internal constraints are driven by the participants themselves in managing projects that involve thinking and action-reactions during interaction within teams. Meanwhile, external constraints are driven from factors outside the participants who are able to inhibit the progress of the project.

| Major scheme | Themes (code categories) | Codes |
|--------------|--------------------------|-------|
| What they actually do | 1. Getting Inspired and Problems | • making the work patterns in the early stages, • looking for some sources of inspiration, • observing, • references, • videos, • digging deep interviews, • feeling as an user, • working together and receiving many suggestions from colleagues (advice of friends), • create pattern of activities |
| | 2. Defining and Customizing User Needs | • combine design requirements, • comfort, • conformity with user requirements, • cooperation, • find the design needs, • feeling as an user, • working together and receiving many suggestions from colleagues (advice of friends), • form, function, material, safety, systems |
| | 3. Developing the Ideas and Solving the Problems | • contradictory ideas, • development • feeling as an user, • many ideas, many things unknown • presentation • solve the design problem |
| | 4. Principles of Work | • feel as an user; • collaborate with colleagues (advice of friends); • enjoy the work process; • intense consultation; • work and intents study |
| What they feel and get | 5. Early Learning | • new learning; • create pattern of activities; • different approach, faster & more efficient; • inspired easily; • structured thinking flow • understanding the project |
| | 6. Next Learning | • confused; • contradictory ideas; • deep thinking; • fun; • knowing the next plan; • Many ideas, many things unknown |
| What obstacles they face | 7. Barriers | Internal Barriers: • time management, • participants' own idealism, • a less critical point of view in capturing new insights, • a lack of extensive knowledge of design, • less adaptability to any problems, • less decision-making, • lack of thinking ability more deeply to achieve a defined goal, and • a pessimistic attitude or other concern External Barriers: • the optimal assistance; • the atmosphere of infrastructure; • work facilities; • the permission; • the restrictions of working days and holidays |
In general, the theme mapping obtained in this study is described in Table 3 and in detail the outcome of each theme is formulated more deeply in subsequent chapters with an explanation of existing theories.

4.1. Getting inspired and problems

Design thinking is a flexible method and functions as an informal method (Watson, 2015). Although it can be derived from any stages, a starting point of the process is called the inspiration stage, the problem or opportunity that motivates a person to find a solution. In short, it is a series of mental constraints that give the framework project team to start, the benchmarks by which they can measure progress, and the set of goals that must be realized (Brown & Wyatt, 2010). In a human-centered approach to problem solving (Brown, 2009), this initial stage is also commonly called the stage of “empathy” or “hear” (Cipolla & Bartholo, 2014; Cleary, 2015). In these inspirational activities and problems, some of the activities that have been encountered by the participants include making the work patterns in the early stages, looking for some sources of inspiration, observing, digging deep interviews to the users, feeling as an user, working together and receiving many suggestions from colleagues, and ultimately trying to gather problems.

At the inspiration stage, I’ve done a lot of activities ranging from learning about cafes, interviewing stages, observing, and feeling myself as a user to get more things in designing later. In addition, the problems gained from the owners and users themselves, what things need to be added and not harmful to both will bring up innovative and fun solutions. (Dendy-P1)

Activities patterned in their early stages before proceeding indicate a planned activity. At least what they have learned since they entered as a freshman until the final project becomes a provision to formulate their final project work plan. This planned activity is indispensable for finding patterns among various sources of inspiration that usually have a common meaning or its repeating appearance (Omar, Rahman, & Abdullah, 2015). Design in their view is actually a pattern that reads from every activity that appears.

From the pattern of existing activities, found the needs that are then applied ... (Stella-P2)

Their sources of inspiration vary considerably, ranging among similar objects and sites of design, literature and the Internet, as well as extreme user activity and behavior over and over again. Participants have documented the results and then discussed them with the team work and counselor in order to obtain the unique problems that will be solved through the design. Because of unique activities derived from various sources and various ways, including collaborating or participating with colleagues, then this stage is also called the process of exploration (Mortati & Villari, 2013).

In this inspiration process, I have done typology studies with similar designs that will be used as inspiration as well as deepening knowledge of literature studies related to my design. At this stage I find the needs and problems that exist. In addition, at the time of the survey I observed the user activity performed repeatedly even the extreme happened. That’s when I documented user behavior. (Olin-P3)

Field data through observation and documentation ... The process of observation becomes one thing that is quite fun for me ... When the process, I can find the unique habits of students. This uniqueness becomes a problem that I have to solve through design. Gathering ideas, I gathered from various sources such as the internet, books and advice from colleagues and lecturers. (Grace-P4)

With the regard to regional development, the participants first studied the history of the region so that they had a balanced bargaining position when they conducted a deep interview with the community in the area. To accelerate their learning process, the participants also learnt by discussing with the “historical lovers community” of their design site. These discussions constitute open-ended
interviews (anything) that is explorative and profound, providing space for potential design problems.

From field survey process, FGD survey, and literature survey and interview with random sample that is residents in study area, color of migrants and community of history lovers of Surabaya. I do to dig up information, collect and then release into the conclusions of the needs of the design of the area that I do. (Erly-P5)

In this multifunctional exhibition booth project, I do interview with employees by asking what is needed by the manager/employees so that their work system becomes effective and efficient. (Jessica-P6)

4.2. Defining and customizing user needs

After performing inspirational and problem-solving activities, the participants subsequently learned thoroughly (increasing their knowledge), working with colleagues and counselors to discover patterns of all the unique (extreme) issues that emerged. The design thinking process requires students to develop users' understanding by listening to, observing and learning about their preferences, needs, and limitations (Fontaine, 2014). Through this process, it is expected to find out the design needs and further can be made adjustments to the needs of users.

... With complex problems, (this method) seamlessly and effectively, helping in terms of sorting and getting answers to the needs that adjust the existing (user) activity. (Dendy-P1)

Designers should be able to find input and ideas as much as possible. It is often seen that designers simply imitate the idea without thinking about its impact. Knowledge of existing materials and systems is also an added value in realizing good product innovation. (Stella-P2)

The determining factor is the depth of thinking and analysis so that the initial insight and concepts produced can be really appropriate and hit on the problems that occur in the field. Another factor that also affects cooperation and solidarity in the group, where each member must be willing to share and help each other. (Grace-P4)

With the reference to the interior product design and interior space utilization, various design requirements are conveyed directly to the context of function, shape, system, material, comfort, and safety.

... But in terms of function and usefulness have been fulfilled, ... the challenge for me is how to create a design that can look not only beautiful but it makes it easier to use later. (Dendy-P1)

... This break-time space project, not only about formation, but also functions, systems, materials and other considerations. (Grace-P4)

Focus more on ergonomics, anthropometry of lounge chairs and sitting position. Due to my design later, I am more concerned with aspects of function and comfort. (Gani-P7)

Meanwhile, in term of the design of the area, it is conveyed that there are needs to be a categorization process (segmentation) and a linking or circulation link that interconnects the function/system within the region.

... starting from the selection and processing of the segment of the region, the right regional model, the circulation, the right facade shape to the development of the theme of the area developed by looking at the history and culture contained in the Kalimas riverside. ... And the design of this area to pay attention to the public facilities of the area so that it can create a comfortable, attractive and has a functional area. (Yongky-P8)
The expectations and design orientations of these participants become clearer as they become aware of their design needs and how they need to adapt them to the needs of the users and even combine the design needs that have been discovered before.

In this case if you already get the need (design), then to design your own will be much more helpful and get ideas that match the needs of existing design at the time. (Dendy-P1)

Because I want my furniture to meet the needs of users and can be used in a long time ... The system then combined with the needs, convenience and suitability of children’s needs. (Stella-P2)

Each of you who is there will be brought back to the memory, but when you see the reality that your place is almost gone and waiting for the moment forgotten by the subsequent turn of the century. You can realize that the main design requirement is that supports the sustainability of the region with the help of the community’s active role in it. Here I find the gap of any design requirement needed to execution stage. (Erly-P5)

4.3. Developing the ideas and solving the problems
When all of the design needs are clear, then the next step is designing and developing them into more concrete and non-abstract outcomes. Thus, design thinking is also a method that initially has a wide concept which can then be central to re-grounded and able to be done in practical level (Dalsgaard, 2014). These activities can include sketching, mind mapping, prototype/model studies, and even digital studies.

Because a lot of looks, so many creations that can be applied. So visual (sketches) can be various. Because of the design of the area, much needs to be considered, then I need to position it to be the actor in the area. (Megawati-P9)

Then, the chosen design is made into a model to know the amount of space and circulation. It was then criticized and developed into a final design. (Olin-P3)

In the design process, I strive to design the facade into digital design, how to provide an attractive, natural and perceived atmosphere that passes through this designated area, determines the right service path, determines support facilities, road forms, water transport such as boat docks and land transportation such as buses and bus stops that can accommodate the needs of mass transportation, procurement of public parking facilities and determine where the right location for these facilities so that appropriate for the community and easy to reach. (Yongky-P8)

The students of this project did everything they deemed necessary to the approach of the solution of design problem. Some aspects of thoroughness covering look at the problem, analyze it again, then solve the problems that arise later, and attention to the target achievement become a concern that needs to be repeated until an optimum outcome condition is obtained. It is also not uncommonly presented to colleagues in order to get potential feedback for users.

The factor of thoroughness in seeing the problem ... and always see what should and should not be fixed in the design so as not to overdo the results and not less also in the results (optimal). (Dendy-P1)

... It helps me to become more organized, where with the stages that exist then I have an obligation to meet the targets in each stage. Stages in design thinking also help me to analyze and solve problems sharper and deeper. (Grace-P4)

I make a presentation to colleagues so that it is expected to be useful for the parties involved (user). (Olin-P3)
4.4. Principles of work
The principle of work is the thing that becomes the guidance or reference during the process. Values are aligned with norms and principles (Spranzi, 2013). Thus, the working principle also means the values that exist to make the design thinking process run well. Some aspects are encountered both in the product design and interior design and the development of the area. There is a guide which becomes the key of these principles to the ever-present success, that is (1) feel as an user; (2) collaborate with colleagues; (3) enjoy the work process; (4) consult with mentors from various disciplines intensively; and (5) force yourself to always be passionate in study and work for optimal design results. This is in line with previous research which reveals that the principles of design thinking are based on at least three key areas: focus on user outcomes, enable multidisciplinary team building, and generate idea as a prototype. Next, it is run again in the loops (Montgomery, 2016).

4.4.1. Feel as a user
With the principle of feeling as a user, the role of participants as designers will gain a much deeper insight, and learn more about any problems that arise by behaving from the user’s point of view in the existing conditions. Adjustment of user needs with availability of existing problem solving can be optimized with this working principle (Harte et al., 2014). This condition also avoids the state of justification for the designer’s own thinking that tends to be subjective. If the subjectivity of the designer takes on a dominant role, the real condition of the problem is not caught. This will lead to the consequences of unsuccessful subsequent design processes in solving design problems set.

... feel yourself as a user to get more things in designing later, but it can also be obtained real problems seen from the owner and the user itself. (Dendy-P1)

Trying to behave like any other visitor. (Olin-P3)

... learn how to design a comfortable area and provide a natural atmosphere by imagining if the person who was at the site planned (Yongky-P8)

Because it helped me to think more deeply about the design issues I raised also saw the problem not only from my point of view but also from the point of view of the person who would use my design as well as the observer’s point of view. Also help me probe deeper into the advantages and disadvantages of my design. (Yiawla-P10)

4.4.2. Collaborating with colleagues
The participants (novice designer) do not forget the work patterns which involve their colleagues and networks (workshops and all involved) during the process of seeking inspiration, exploring problems, defining and formulating design needs, generating ideas for their thinking. This collaboration is useful to support the stability of processes and outcomes which they produce at each stages, supporting morals, and creating emotional bonds in adapting and helping other’s difficulties. It is able to increase students’ motivation and encourage their understanding until producing the final design.

Seeking lots of inspiration and asking for advice from your existing friends (Stella-P2)

Become closer to colleagues, give each other ideas and input. Meet new people and collaborate with them. Must be able to adapt and deal with problems quickly ... Another factor that also affects is teamwork and solidarity in which each member must be willing to share and help each other instead of dropping each other. (Grace-P4)

... learn from the side of social skills and negotiation to the parties concerned to keep everything stable. Good moral and material support, good negotiation and proper contracting, and manpower assistance. (Jessica-P6)

... and advice from friends–friends is the key to the success of the designer in understanding, understanding, and achieving good design results. (Yongky-P8)
4.4.3. Enjoy the work process
The participants went through all steps of design thinking with its consequences. The method that is
deemed to be good does not necessarily bring a real and perceived convenience. The key to their
success is that they can enjoy it from start to finish. Some of the difficulties include the gap between
their sketch ideas and abilities, the suitability of workshops with the cost, as well as the time.
Additionally, this is very understandable to them so they can prepare better.

... sometimes, things that are thought too complicated so that the sketch process is not
maximal and not according to our wishes. (Dendy-P1)

The designer must find the appropriate builder and the adjustment of material and cost so
as not to be too expensive. (Stella-P2)

The positive thing I received was that I had to think before I acted in the sense that I was
required to have a way of thinking and then apply to my design. (Olin-P3)

For me, a design student whose ideational ability requires a long process. Time is of the
essence to me because it is not uncommon that ideas will emerge over time ... (Jessica-P6)

I better understand how the design process should be so that it can produce a useful design
and give impact to the public. (Gani-P7)

4.4.4. Consulting with mentors from various disciplines intensively
Another important working principle is involving mentors in an intensive consultation. This is useful
to the tutorial process for catching up work, as a means of validation of every idea generated, and
even as a peer to generate ideas.

The solution I have got is through the process of brainstorming with supervisor and peer
group. Based on this process, I get the initial concept that matches the initial problem.
(Grace-P4)

... Consulting with supervisors helped me a lot and aligned my target position that was so far
out of my group of friends. (Jessica-P6)

The factor that determines my success is the patience of my supervisor when I consult and
the ideas expressed as inspiration for my idea ... (Yiawla-P10)

4.4.5. Force yourself to always be passionate in the study and work
Each student has the potential and characteristics of their respective work. It is also a driving force
in maintaining the stability of work done primarily in the pursuit of specified project targets. The
context of self-reflection, learning more from multiple sources, rethinking previous findings, and
more critical in developing components in the resulting design are the way participants participate
in maintaining their study and work spirit.

I will try to think more critically and deeply about the design of this break-time space. Not
only about formation, but also functions, systems, materials and other considerations.
(Grace-P4)

I feel this design is still far from perfect. Although it looks easy, the thing that makes
it difficult is when the design realizes. The development of the design also can not be
maximized. So, despite my time, I’m still challenged to re-explore my design ... Multiplying
self-introspection, learning a lot more, and reading more to deepen my knowledge have
made my ordinary designs finally able to meet or answer the design needs and problems
that have been put forward before. I also need to deepen the observation ... (Yiawla-P10)
4.5. Early learning

Students do not always have a direct understanding to the problems of the design. They sometimes take more time in the early stages with a process called building the mindset first. Building a mindset that is formed slowly but growing eventually leads to their understanding of the project. This makes them easy to understand and accepts new things from different angles. It is not uncommon to encourage them to be easily inspired by ordinary things but with an unusual angle. Building a framework of thought begins to form and makes them also able to understand the project at hand and will lead to a particular goal.

That’s when I see what I have not seen before ... Because it’s an experience I’ve never experienced before. From observation made me find a different experience. (Olin-P3)

Benefits that can be obtained is the researcher can find out how far the development of the study area, the list of weaknesses and advantages. It’s all as a consideration of the execution of the design. (Erly-P5)

... this method is impressive because I am getting new learning and easier to get inspired ... What challenges me is in finding new things, seeking inspiration or determining not only inspiration from the mind in the head but also the worthy ... This method provides a frame of mind that leads to more specific design issues, so that it is not too widespread, in the sense of being able to create a guide in my design. (Jessica-P6)

This method is impressive to me because with a small idea or inspiration like “Sende-the Lazy Chair” conditioned nowadays, it has been very helpful in inspiring low budget with massive mass production. (Gani-P7)

I am satisfied with the stage of inspiration that I have a group through. We were taught different ways of gaining inspiration through insight gathering. So what needs to be done next is to maximize ourselves in deepening the insight we get to get more inspiration, basic knowledge and opinions on the design to be made. (Yiawla-P10)

This learning process ultimately shows students that workings with the teams in a combination of activity-based investigation and project development will build new knowledge. Building a knowledge base in the initial phase is very important (Suprobo & Santosa, 2017). The context of student-oriented constructivism in studying their project users is being developed by the design thinking process (Buffington, 2014; Gross & Gross, 2016; Johnson, Kieling, & Cooper, 2013). This early learning indirectly allows the flow of organized and progressive thinking to reach the intended targets. This is what makes this design thinking approach as well as different perceived work tools faster and more efficient in terms of time for them.

What I get in terms of the process of thinking with complex problems is actually smooth and effective, helping in terms of sorting and getting answers that match the needs with existing user activities. (Dendy-P1)

The positive benefits are more focused and more systematic. (Olin-P3)

... help me become more organized, with the stages that exist then I have an obligation to meet the targets in each stage. Stages in design thinking also help me to analyze and solve problems sharper and deeper. (Grace-P4)

Get inspired quickly, efficiently and according to the needs I want to design ... provide a very significant contribution compared to the way I use it on other projects ... very different and efficient. (Jessica-P6)

... the first for me is the phase stage of what I do to achieve the final result becomes more structured well, so I can arrange what I should do first. (Gani-P7)
4.6. Next learning

In the next stage of learning after the participants understand what they are dealing with, they are usually more frustrated. All the ideas produced are easy to translate and understand but they realize that they are abstract in nature. The difficulties encountered are precisely how the abstract contexts are able to be visualized or concreted even though the alternative development of those ideas is sufficient. Sometimes more and more ideas also actually bring their own difficulties for the participants in making it happen. What is thought is not necessarily the same as what will be applied in the plan.

The more ideas the more unknown will encourage the participants to try to find out more in depth as the process toward optimal design completion conditions.

The inhibiting thing is the time of ideas that arise a lot and when applying to the sketch form is too complicated, and it should be aided with a design analogy to be simpler in applying the sketch. (Dendy-P1)

The most impressive thing is knowing the work process that I think is not so complicated but in reality, it’s different from my thinking. I am able to know and learn the techniques of connection and manufacture of materials from iron that previously I have not known in detail. (Jessica-P6)

... as time goes by I get some ideas from the insights I’ve made and produce four scenarios. My other difficulty at this stage is in the alternatives and the development of the design. There is not much I can change from some of these scenarios. (Yiawla-P10)

Meanwhile, the process that has been undertaken by the participants who have been structured and systematic well in the end to provide an advantage in determining the next step.

The positive thing about this design thinking process is the first for me that the stage of what I do to achieve the final result becomes more structured well, so I can organize what I should do first. (Gani-P7)

Design thinking helped me systematically perform the design process and made it easier for me to determine my next design step. I pay more attention to the time and my work more tidy. (Yiawla-P10)

But also not infrequently the ideas are increasingly developed even lead to an ambiguous and contradictory situation between ideas one with the other so as to make the participants of this beginner designer in a state of confusion.

... Sometimes the resulting idea becomes confused ... Sometimes some ideas add to the existing space problem ... Confused ... (Stella-P2)

First, my constraint during the inspiration stage is that I am very confused because it is different from what I did first. (Jessica-P6)

4.7. Barriers

In carrying out the design thinking method to complete their project, the participants face various obstacles. These constraints are generally divided into internal and external constraints. Internal obstacles encountered include time management, participants’ own idealism, a less critical point of view in capturing new insights, a lack of extensive knowledge of design, less adaptability to any problems, less decision-making, lack of thinking ability more deeply to achieve a defined goal, and a pessimistic attitude or other concern.

... My own poor timing at all stages (Dendy-P1)
Too idealistic designers will make for too long finding the best designs. (Olin-P3)

I do not have any interesting new ideas ... I feel that I have not been able to sift through insights deeply and critically ... The extent of knowledge on designs from home and abroad, in my opinion, will affect how much creativity the designers have in generating new designs ... Given these constraints, I do not able to complete all tasks with the maximum and not able to adapt to new things and decision-making. In the implementation stage, many problems inhibit prototype production. Therefore, it is necessary to take decisive decisions ...

(Grace-P4)

... how to think to produce a suitable prototype but pressed with a budget capability that is not high. (Jessica-P6)

I have not fully sought to save ancient buildings in the study area. (Erly-P7)

... Pessimistic attitude towards yourself and comparing with others. Because of my pessimistic attitude, I wasted a lot of time in sketches. I experienced fear if my design is not accepted because it looks unimportant. (Yiawla-P10)

While the external constraints encountered by the participants include the need for expert partners that led to the assistance of optimal project financing determination, the atmosphere of infrastructure and work facilities that are less supporting the comfort and flexibility of work, the permission during the survey, the restrictions of working days and holidays, and a hardware problem which suddenly breaks down.

The idea must be realized, but it requires experts. The materials used should also be easy to obtain. The costs incurred are also abundant to realize unusual ideas ... The University should also allow time for students to explore at home because the studio can not inspire anything because of the weakness of the wifi and the unfavorable studio atmosphere with comfortable chairs and tables. (Stella-P2)

The thing that challenged me was not being allowed to document the entire room at the time of the survey by the Mall management that was the object of my project. (Olin-P3)

The difficulty of getting the right craftsmen ... limited time and human resources so that prototype can not be produced maximally. (Grace-P4)

... is limited by the presence of hardware and the skills of artisans in the production process ... Budget, holiday (hours of work), intentions and priorities of workers to my project ... Performing tasks in the campus laboratories that have been provided is one solution that I can take but it nor does it make me feel completely comfortable ... I sometimes need files that are only on my home device, laboratory opening hours to be filled with certain course classes, and other inaccuracies that I might get from work at home. (Jessica-P6)

When the image layout process is done in some time, my file is suddenly broken and can not be reused. This really makes me as a designer becomes difficult because the time and stamina are drained away suddenly. (Yongky-P8)

One of the schools (the study object) questioned my survey permit and asked me to make a new proposal. After I created and submitted around February 2017, I still have not received any news until now (March 2017). Meanwhile, in the second school, I received the answer that the person responsible for approving my proposal, was sick and until now there has been no news. Finally I submitted two other kindergartens (other study objects) and went well even though I was chased by time. (Yiawla-P10)

The subject of this constraint in previous research has also been able to be translated that it is possible to arise from individuals and participants of design process thinking that tend to be effectively implemented collaboratively and participatively. Thus, it can not be denied that the constraint is very
likely to occur in individuals, collaboration between individuals, organizations, processes, implementation and method (Pirinen, 2016).

5. Discussion
Students as novice designers undergo a potentially Business Incubator (BI) project with Design Thinking approach, which is essentially divided into three major phases. Furthermore, to ensure that participatory activities of the students in the implementation of the Business Incubator project, some requirements are needed: (1) getting inspired and problems, (2) defining and customizing user needs, (3) developing ideas and problem solving. The first two phases for a design thinking process in originality are in the first major phase of inspiration (Brown, 2009; Brown & Wyatt, 2010). Meanwhile, for the normally separate ideate and implementation phases, the researcher proposes to be a major part of the idea development and problem solving phase.

In consideration of the researcher, this is most likely determined by the constraints encountered by the students during the process, either due to individual constraints or other external constraints during the process (Pirinen, 2016). These constraints are factors that can slow down the process of design thinking stages. Another factor is the nature of the learning that is run by the students within the scope of internal self that is still in a learning process or double position as a learner as well as project executor. The construction of new knowledge is perceived quite easily, quickly and effectively at the stage of inspiration and problems but this is different when the redefining process follows adjusting problem solving to user needs.

The participants are very likely to hold concepts with simple prototypes in this second stage and they have begun to show difficulties to imagine how these ideas will be realized. Even the other problem is how these ideas can be generated if the reality between the problems and the needs of users is not assymmetric. What has been done and experienced by these novice designers are, in essence, to determine the optimal time by putting the big stage of design thinking inspiration into the first two phases of the Business Incubator (BI) project, which are getting inspired & problems and defining & customizing user needs. Meanwhile, they proceed quickly in two phases of design thinking (Ideate & Implementation) into one phase only, namely developing idea & problem solving. This is understandable because the thought of abstraction in defining & customizing user needs phase has turned back to concrete thinking in the developing idea & problem solving phase. All of these can be viewed as a process of transformation, i.e. a constructivism learning approach that blends in the design thinking process. (Gross & Gross, 2016).

The principle of work which becomes the values in the overall design thinking phase must remain and according to the consideration of the researcher should further refine the results of Montgomery (2016) which are only three main areas. The principles can be seen in Table 4.

| Table 4. Comparison of Working Principles of case study results and according to Montgomery (2016) |
|---------------------------------------------------------------|
| **Principles of Work DT BI Design Thinking—Business Incubators (BI)** | **Principles of Work DT Design Thinking (Montgomery, 2016)** |
| Feel as an user | Focus on user results |
| Collaborate with colleagues | Enable multidisciplinary team building |
| Consult with mentors from various disciplines intensively | Idea is prototype |
| Enjoy the work process | Run again in the loops |
| Force yourself to always be passionate in study and work | |

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On the basis of comparative considerations between the results of practical studies and theory, it can be adjusted that the principles of design thinking based on BI include: (1) Feel as User; 2) Build a Multidisciplinary Team from co-workers & expert mentors; (3) Enjoy the work process with the concrete output and keep it up to the optimum result; (4) Force yourself in Study and Work.

The movement of iterations that shifts from one phase to the next by always back and forth is at the initial learning state in the realm of concrete thinking and subsequent learning in the realm of abstract thought. At the end of iteration movement, it will gain momentum to overcome the obstacles that exist in achieving the goal BI project. The momentum is largely determined by the working principle undertaken by these students, primarily driven first by themselves (Bedford Russell, Passant, & Kitt, 2014). Then, the quantity of study and work becomes important by being replicated through collaboration and participation in the team so that quality is easy to obtain because of the wide selection of ideas to develop. The model in understanding the case that occurs in the results of this discussion can be seen in Figure 4.

Meanwhile, based on the above-mentioned model, professionalism is not relied only on trust factor which bring the common interest (Suntornpithug & Todorovic, 2015), but also on how they can force themselves to run with reference to the working principle, while running a double role with all its constraints (Low, 2015).

Thus, this model has actually been executed by the participants and the result formulation has provided model improvements in the phases of the design thinking process and the renewal of the working principle. Of the ten participants involved, four projects were found within the scope of Business Incubator (BI) and still continued to develop until the preparation of this article. While there is one project that can be directly utilized by the community (user) who need it.

6. Implications for the development of business incubators in higher education

Higher education has an important role as a driver to accelerate the progress of human development comprehensively. These include education, social welfare and the environment. Therefore, Business Incubator (BI) established at the university is expected to be able to prepare the candidates before entering the community with all the competence that will be owned.

Indeed, some constraints faced by them always exist, both internally and externally. Among all the obstacles which mostly emerges, they can handle at least what they can control (i.e. their own individual). Business Incubator (BI) within the university is the provider for the availability of a project, apprenticeship, or institution capable of empowering research present at once in curriculum activities. Additionally, this will increase the professionalism and competence of the students involved.

Reasonable and flexible design thinking approach with a phase update of the process should be a sufficient guide to consider. The update of the phase should give more portions in the inspiration stage which is split into stages of inspiration and problems as well as defining & adjusting needs. Furthermore, the portion of the development and solving the problem into one phase needs to be viewed positively given the level of ability of these students in building their knowledge construction. Another thing that can overcome the learning problems in the beginning (concrete) and subsequent learning (abstract) is the need to do phase treatment repeatedly driven by a strong working principle. Four existing working principles should be implemented intensively in each phase and are expected to ultimately provide a strong momentum for achieving a design goal. The principle category of work has also undergone renewal. With emphasis in the early phases of design thinking and
Figure 4. Model Design Thinking—Business Incubators (DT-BI).
renewal of its working principles, BI-based design thinking methods are expected to provide a tangible contribution to higher education that runs a Business Incubator (BI) with the same contextual.

7. Future research
Creation of momentum with high acceleration in running the design thinking phase leading to the occurrence of goal design inspires the interest of future researchers to investigate deeper. Possible questions to arise are:

1. How many times are needed for the required iteration until there is the right momentum to solve the design problem?
2. How does the working principle give a strong impetus to generate that momentum in each of its phases?
3. How many weights of the four principles of design thinking impact the success of the design: either simultaneously or partially?

Finally, future research is expected to generate also a model to measure the momentum strategy of design thinking implementation in Business Incubator (BI), especially, that related to the type of project case that will be encountered.

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