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REUSING RESIDUAL MATERIAL OF FURNITURE PRODUCTION IN DESIGN ARTIFACTS BY UNIVERSITY-INDUSTRY COLLABORATION

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Abstract

Furniture design classes in interior design programs mostly lack on production knowledge. Although the knowledge in this area is provided theoretically, tactile knowledge cannot be transferred neither oral nor verbally. At the other hand, furniture industry is the place where this kind of knowledge is utilized continuously. In the global World, the industry must catch up with new trends that are part of the endeavors in design in Universities. Problems due to the nature of industry and design problems of students and teachers meet at furniture itself but industry and University are still not close enough.

In this paper, possible collaborations between industry and University are discussed. The furniture design class which is held in an interior design department is organized at the scope of industry-university collaboration. In this sense, the director of a mid-sized furniture firm is invited as a tutor for one semester. The subject of the class is determined as a typical problem from industry, reuse of residual materials of production. These materials are converted into design artifacts. The output of this study is discussed in this paper. This discussion includes evaluation of the collaboration through qualitative and quantitative data of student reports, surveys, and partner interpretations.

Keywords: Furniture design education, industry-university collaboration, re-use, residual

1. Introduction

Furniture design is a crucial element in interior design and the fact makes it to be an important class in interior design education. Most of the institutions construct the class on verbal basis and in some cases a prototype is produced at the end. Usually students organize the production out of institution and cover the expenses themselves. In this type of education, design dominates over production of the product and lecturers have little voice on production. Low quality products are expected. In most cases design is shown on paper or screen and production is omitted. At the other hand a few of the institutions have workshop facilities and provide the classes on applied basis. Students can produce at the workshop themselves. Materials are provided by the institution or not. In this manner design and production continues together, lecturers have more voice over production and higher quality products are expected. It is difficult to keep a workshop facility running due to high budget demands. For this reason, most of the interior design departments in Turkey are missing a workshop facility. Another way to hold the furniture class in an applied manner is to have cooperation with industry where a facility continues to produce. Classes are adapted to this kind of collaboration. Students experience the production on site. This type of class set-up refers to the term University-Industry Collaboration (UIC).

1.1. University-Industry Collaboration (UIC)

University-industry collaboration is a relation which has benefits for each side. University-industry collaboration (UIC) refers to the interaction between any parts of the higher educational system and industry aiming mainly to encourage knowledge and technology exchange (Ankrah and Al-Tabbaa, 2015).

University and industry have diverse expectations from this collaboration. Expectations of the University can be summarized as supplying contributions, extending industrial experience of the staff, academic publishing, obtaining patents, support for internship from industry, experience for students by developing their projects, support from industry for social gatherings. Expectations of the industry can be summarized as rapid solution to its problems, solving problems without employing high salary staff and high funded R&D facilities, obtaining knowledge from universities for international projects, gaining support for obligatory certificates, bearing in mind needs and problems of the industry for theoretical research (Odabasi et Al., 2010). Usually the collaboration is set up on a project for an invention. By this way University fulfils its responsibilities to the society and science. Industry makes profitable added values which consequent helps to the well-being of the society. It could be indicated that society is the third partner in this collaboration. If the project leads to an added value for industry it would lead to better profits and the industry will reach its main goal. But at the other hand university must confine itself to abstract goals as reputation in science world. The dimension of education, which is one of the biggest missions of the university stays missing. In educational aspect of UICs mostly doctoral or post-doctoral studies are aimed which are going on project driven base. For under-graduates there is the possibility of project-based internship. Other than that, under-graduates could only have the possibility of having the regular internship at industry. This is the outsider's perception for UIC which is partly correct but missing some facts. Ankrah and Al-Tabaa (2015) makes the progress clear in their systematic review on UIC. They mention that organizational forms of UIC starts with personal informal relationships containing academic spin-offs, paid or free individual consultancy, information exchange forums, collegial interchange, joint and individual lectures, personal contact with university academic staff or industry staff, co-locational arrangement. The start of UIC is mostly open to educational income and it is also free from the formal procedures which are required in invention-oriented approach. Ankrah and Al-Tabaa (2015) also mentions their findings about the activities during UIC and the tittle for training is especially remarkable for educational dimension: they have found out that industry involves in curriculum development. This type of activity necessitates a close relation between University and the company. If there will be an involvement to develop the curriculum, involving person must be in close relation with academics, the school, and the students. It can be achieved in two ways: By visiting professor who does an internship in industry to develop a more practical vision from the industry and later pass it to the students. The other way is the so-called Associate Professor who is a professional works part time, teaching at the University (Alfonso et al., 2012) Employing an associate professor from industry can solve many problems in joint action with academics. An example of this kind of collaboration will be discussed in following parts of this paper.

2. Materials and Methods

The study is based on a collaboration between Eskisehir Technical University – Interior Design Department and KYS (Kenan Yeni Sandalyeleri). The collaboration is the continuing phase of a previous collaboration done in 2016. The study is based on the newer collaboration done in 2019.

2.1. Past Collaboration

The collaboration is done in 2016 when interior design department was part of another University. The former University used to have a wood working workshop dedicated to the department. Furniture Design classes were held in that workshop. The collaboration started through personal informal relation with the tutor of Furniture Design class and owner and designer of KYS. KYS is a small sized (less than 50 workers) company dealing with chair making with bent wood lamination technique. The collaboration was based on material grant and support for final production. The class was held at institutions own workshop and final products are produced at KYS. In this collaboration progress of the class was more valuable than the end products. From the survey on student and company owner's thoughts it was clear that expectations of industry which are finding new design ideas, finding new employees and interns from students, and making reputation by this collaboration were mostly fulfilled. And from the University side, expectations as making students experience production and reserving minimum fund for this to happen, having new collaboration possibilities by starting this collaboration are mostly fulfilled. Lecturer published an article out of this collaboration which was also another expectation (Altın, 2016).

2.2. Newer Collaboration

The collaboration is repeated in 2019. This time some revision to the progress was needed because needs and expectations for the University and the industry were changed. Basically, University's

expectations are still oriented to education but at lower layers some differences occurred. Anadolu University where the interior design department belongs to was separated into two Universities and interior design department was transferred to the newly established Eskişehir Technical University. The wood workshop which used to belong to interior design department was left at the former University. Consequently, the need for a workshop occurred to hold furniture design classes in an applied manner. At the other hand, there became an increase in student population and decrease in lecturer numbers which made the class inefficient unless the institution hired new staff. In these circumstances the basis of this collaboration was set up. In this new collaboration it is decided to have the owner and head designer of KYS to teach furniture design class as an associate professor with existing lecturers. By this way shareholders expected to have direct transfer of knowledge. While reconstructing the class discussions are made on needs of both sides. KYS specified a common problem in wood working industry, the production residuals of cut-wood (Yetis, 2016) The ongoing production process in KYS is based on wood bending. Slices of beech wood is glued and compressed in moulds under high temperature and pressure. The product is a 2-dimensional profile which is then cut vertically in identical slices to be used as chair legs or arms. If the end-product needs more special shape, which are usually used for bottom and back support, the remaining parts could not be used as a part of other chairs. But these remaining parts still have potential, and it is difficult to identify them as residuals. Other than bent wood residuals KYS has remaining wood pieces coming out of CNC routing of panellised wood. While identical shapes are cut from wood panels the remaining piece becomes as a pattern and it also have potential to be used as decorative purposes. Other wood residuals are tiny wood chips and sawdust which are difficult to be reused in a design scenario unless they are recycled. KYS revalued these cut residuals in some of their products as lampshades, some tabletop or hang on wall accessories which cannot be categorized as furniture. KYS is a small-scaled firm with 30 employees and it is difficult to employ a full-time designer. For this reason, the company owner is the only designer who works for creative purposes. The residuals are in many shapes and dimension which makes work with them a fatigue duty. Pieces from diverse profiles have diverse forms but also because of the low precision cut they also have variety in size. Only one piece can have many variations to check for and recutting and assembling diverse pieces makes these variations nearly infinite. This makes the design process a lot more different than the ones that the designer starts designing from scratch. The design process needs lots of trials and redoes which is like doing a jigsaw with infinite pieces. For this reason, a different design thinking is needed to increase efficiency. As mentioned before KYS is limited to one designer and because he is the owner of the firm design is not his sole occupation. A collaboration with the University would be useful for the industry because free minded approach of young people (students) could accelerate idea generation.

Both University and industry had expectations from this collaboration: From University's side to continue the class in an applied manner and use industry facilities, to have access to production knowledge from first hand, to minimize material costs for the class, to minimize production costs, to have a lower student per lecturer ratio, to have attention from public to this collaboration by an exhibition of final products and to publish the story of the collaboration were the expectations. For industry to have new ideas for added value products, to have the experience of teaching and academic environment, to promote company and its products by this collaboration and have reputation were the expectation. Set up of classroom based on these facts.

2.3. Classroom Set-up

2019-2020 first semester Furniture Design class was open in three groups for three lecturers. Two of them were full-time professors and KYS owner has conducted his own group. 62 students were enrolled to the classes. Students were free to choose their desired group. The classes are held at the same place with students all together, but every group had separate critics from their dedicated lecturers. Students made up working groups of 3-4 people and they were free to choose their group members. To introduce the production facility, production methods, existing products of the company and residual pieces, a trip to the factory was organized. In the following lesson, a selection of residual pieces was brought to class and students are asked to examine pieces and make compositions. Every group then showed their ideas. In this exercise students are not confined with restrictions of choice of pieces or to realize a function. Student groups are asked to document every phase of their form research with photos or video, they are also asked to prepare a web blog explaining everything they have done during their research. In the following weeks students are asked for more exercises to get used to with pieces and their potentials to create new forms. One of the exercises was titled as "divide-cut-multiply". In this exercise students are encouraged to cut the pieces in different shapes and combine them. It was difficult for them to imagine how they could cut pieces and attach them together. Because they could not cut the pieces in real. In another exercise students are asked to take photographs of pieces and use computer image editing software to cut the photographs and

create a collage of possible compositions. In the following lessons when students familiarized with pieces function is criticized and students are asked to confine their multiple ideas. At the end of studio critics students started production at KYS facility. The wood related production has been done in KYS but for other materials if needed students used the other workshops in the periphery. For these kind of production students covered their own expenses. Also, the cost for transportation of product was covered by students. The end products are exhibited to the class. Students are asked to answer a questionnaire and prepare a report explaining each week of the class. Both are used to evaluate the class performance and collaboration. The idea to hold an exhibition open to public could not be possible because of the global pandemic.

Figure 1: Central tendency on the positive expected questions

2.4. Methodology

Collaboration is evaluated on realization of the expectations of both sides. Research is based on student reports and surveys. For surveying a questionnaire is prepared. Students are asked to answer questions. Also, at the end of the collaboration, to understand the industry's view about this collaboration a questionnaire is prepared and KYS owner is requested to answer.

The questionnaire prepared for students included 33 questions. 5 questions are about demographic data, 28 questions are about evaluation of the class, 25 of those are 5 grade likert scaled and remaining 3 are open-ended. Questions are answered individually. The questionnaire prepared for KYS includes 79 questions, 16 are open-ended and the remaining 63 questions are 5 grade likert scaled.

Student reports are constructed on qualitative data. Students are asked to prepare a report explaining their progress in class. Every group had one report and 14 class weeks are explained on 3 titles: "What we have done this week.", What we have learnt this week." and "What we felt this week."

Quantitative analysis for student questionnaires is evaluated on IBM SPSS Statistics v24 and qualitative analysis are made on Nvivo 12.

3. Results

The results section should detail the main findings and outcomes of your study. You should use tables only to improve conciseness or where the information cannot be given satisfactorily in other ways such as histograms or graphs. Tables and figures should be numbered serially and referred to in the text by number. Following figures show demographic data of the class: 54 students have answered to the questionnaire. 13 Students are male, and 41 students are female. 15 students are in the group of the associate professor. 1 of the students was took the class for the second time. The questionnaire's Cronbach's alpha score is .861>1.

3.1. Analysis on Student Surveys

It is found out that students are mostly positive about the class. They have answered 22 questions positive which are expected to be so (M=4.17 / 5). Some questions have relatively low means. The survey shows that students did not find residual materials helped in design. Also, students do not feel themselves

sufficient to work at furniture industry. Students also liked to have more possibility to have hands-on experience during production. Students are not feeling confident about material knowledge.

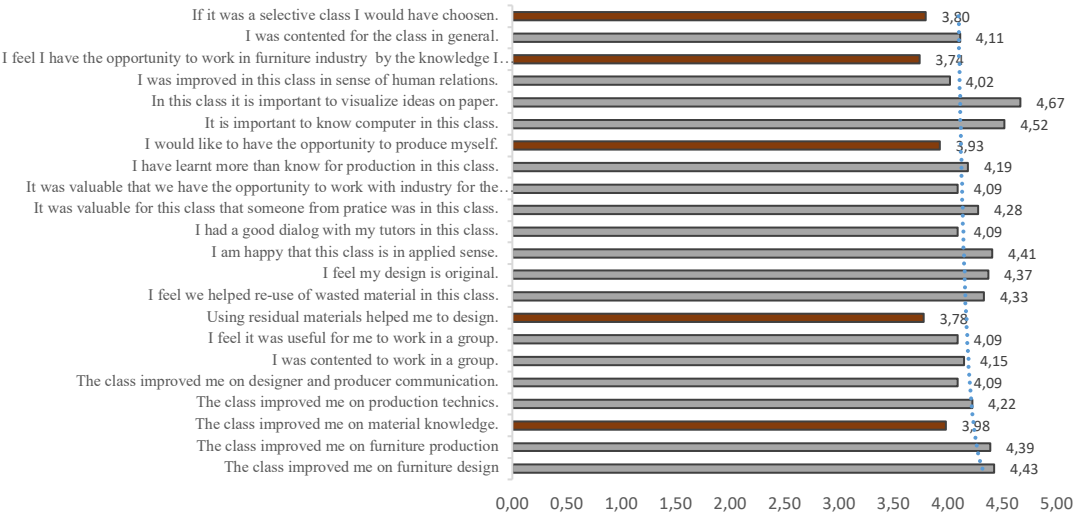

Figure 2: Central tendency on questions which were expected to be answered positive

Students answered questions which are expected to be negative: "The class was hard on budget." M = 4.19 /5 and "The class was hard on timing." M = 3.54. To understand the relations between positive and negative answers correlation analysis has been checked. (Table 1) The results have shown that the students who feel not to choose the class are upset about timing, budget, and limited opportunity for hands-on working. Working in groups and dialogues with tutors have no effect on this tendency.

Table 1: Correlations

		This class was hard on timing.	This class was hard on budget.	I was contented to work in a group.	I am happy that this class is in applied sense.	I had a good dialog with my tutors in this class.	If it were a selective class I would have chosen.	I feel it was useful for me to work in a group.	I would like to have the opportunity to produce myself.
This class was hard on timing.	Pearson Correlation	1	,308*	-0,263	**-,414****	-0,202	**-,535****	-0,206	-0,250
	Sig. (2-tailed)		0,023	0,054	0,002	0,143	0,000	0,135	0,068
This class was hard on budget.	Pearson Correlation	,308*	1	-0,054	**-,316***	-0,195	-,269*	-0,178	**-,394****
	Sig. (2-tailed)	0,023		0,697	0,020	0,158	0,049	0,198	0,003
I was contented to work in a group.	Pearson Correlation	-0,263	-0,054	1	0,115	0,124	,285*	**,735****	**,372****
	Sig. (2-tailed)	0,054	0,697		0,406	0,373	0,036	0,000	0,006
I am happy that this class is in applied sense.	Pearson Correlation	**-,414****	-,316*	0,115	1	,451**	,602**	0,224	0,263
	Sig. (2-tailed)	0,002	0,020	0,406		0,001	0,000	0,103	0,054
I had a good dialog with my tutors in this class.	Pearson Correlation	-0,202	-0,195	0,124	,451**	1	,499**	0,094	**,355****
	Sig. (2-tailed)	0,143	0,158	0,373	0,001		0,000	0,500	0,008
If it weree a selective class, I would have chosen.	Pearson Correlation	**-,535****	**-,269***	**,285***	**,602****	**,499****	1	0,225	**,369****
	Sig. (2-tailed)	0,000	0,049	0,036	0,000	0,000		0,103	0,006
I feel it was useful for me to work in a group.	Pearson Correlation	-0,206	-0,178	,735**	0,224	0,094	0,225	1	0,265
	Sig. (2-tailed)	0,135	0,198	0,000	0,103	0,500	0,103		0,053
I would like to have the opportunity to produce myself.	Pearson Correlation	-0,250	**-,394****	**,372****	0,263	**,355****	**,369****	0,265	1
	Sig. (2-tailed)	0,068	0,003	0,006	0,054	0,008	0,006	0,053	

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The question "I had a good dialog with my tutors." was checked for positive answers for each tutor and students of the associate professor answered M =4.13 / 5 positively. Full time professor A's students answered M = 4.3 / 5, B's M = 3.8 / 5. The figures show that there were no problems about dialog with associate professor.

For a qualitative analysis 3 open ended question which are mostly focused on suggestions for the class are coded. When they are asked for suggestions instead of giving new suggestions most of the students criticized the existing class. From the answer following codes and frequencies are acquired:

- It was hard on budget (n=20).
- It was good to work with industry (n=12).
- I would like to have hands-on experience (n=9).
- I have not got enough materials for production (n=9).
- It was hard on timing (n=9).
- Organization was not good enough (n=9).
- It was hard to go to the factory (n=8).

The highest frequency was on the budget. Most of the students mentioned that they are contented to work with industry and a lot of them also mentioned that how they liked to have hands-on experience. A surprising fact came out of answers was that there was a shortage on material supply. Students who have mentioned "working with industry was good" also mentioned "it was instructive" (n=5).

Some of the student comments are:

"It is possible to learn a joinery detail that I would never imagine from an ordinary craftsman on site. Craftsmen are sage of the work so they have enormous experience. It is impossible not learn something from them."

"To be honest, I finally have learnt and had the opportunity to practice the technics properly which I have learnt in class or read…"

One report from every lecturer's group has been selected randomly and they are evaluated in NVivo 12. Reports are mainly coded for the titles "things that have been done, things that have been learnt and things that have been felt". Randomly selected groups were consisted of 3,4,4 students 11 students in total. It was assumed that all the students have collaborated for preparing the report. Coding has been done on text and images. (Table 2).

Table 2: Codes and frequencies

		A	B	C	Sum	
Things that have been done						**203**
Computer visualization		0	4	0	4	
Material tryout		2	0	3	5	
Finding a function		10	15	1	26	
Trials with scaled models		0	1	1	2	
Relating with space		0	0	0	0	
Modular design trials		6	0	1	7	
Experiments for joinery		22	16	4	42	
Presentation		1	4	1	6	
Design research on computer		12	16	5	33	
Design research on paper		13	6	4	23	
Design decision		2	0	2	4	
Dialog with craftsmen		0	3	4	7	
Production						
	Finishing	0	1	3	4	
	Assembly	0	1	2	3	
	Parts forming	0	1	1	2	
	Production documentation	0	0	4	4	
Production research						
	Joinery trials on computer	8	8	0	16	
	Physical joinery trials	0	6	1	7	
	Joinery trials on paper	6	0	2	8	
Things that have been learnt						**66**
Familiarizing with pieces		5	5	0	10	
Design with limits		0	0	0	0	
Design					0	
	Importance of working with actual materials.	1	0	0	1	
	Form-Function relation	3	1	0	4	
Production details					0	
	Power tools	4	6	9	19	
	Production Planning	0	0	0	0	
Material knowledge		2	2	6	10	
KYS and wood lamination		5	1	2	8	
Dimensioning		1	0	1	2	
Reuse- Recycle		0	2	0	2	
Computer visualization		3	1	0	4	
Cost analysis		0	3	0	3	
Ergonomics		0	3	0	3	
User in design		0	0	0	0	
Teamwork		0	0	0	0	
Things that have been felt						**47**
Positive						39
	Fun	0	0	2	2	
	Pride	0	0	0	0	
	Trust	1	0	0	1	
	Excitement	3	2	2	7	
	Pleasure	0	1	1	2	
	Contented	2	1	3	6	
	Motivated	2	3	2	7	
	Happy	1	4	6	11	
	Relaxed	0	1	0	1	
	Appropriation	0	0	1	1	
	Novelty	1	0	0	1	
Negative						8
	Lack	0	0	0	0	
	Disappointment	0	1	0	1	
	Fear	1	5	1	7	
	Unmotivated	0	0	0	0	
	Upset	0	0	0	0	
	Tired	0	0	0	0	
	Strain	0	0	0	0	

As seen from figures students mentioned more of that have done over that they have learnt and felt. There was no restriction for this to happen, but it supposed to be occurred because students believed the report will have effect on their marks. Under the title "things that we have done" the most mentioned subject is the experiments for joinery (n=42), design research on computer (n=33) and paper (n=23) are also mentioned more than other subjects. Especially design research on computer was coded mostly for pictures of examples of desired design. Mentions for finding a function (n=26) is also remarkably high. These mentions mostly included explanations and hand drawings of different design scenarios. It can be seen from figures that students mentioned joinery (total n=31) also in production research. This can be evaluated as they had difficulty in joinery, or it was more interesting for them because it is the first time they have an experience with them.

Some of the students' mentions:

"We decided to focus on the lighting function but at the same time we were dealing with the separator idea."

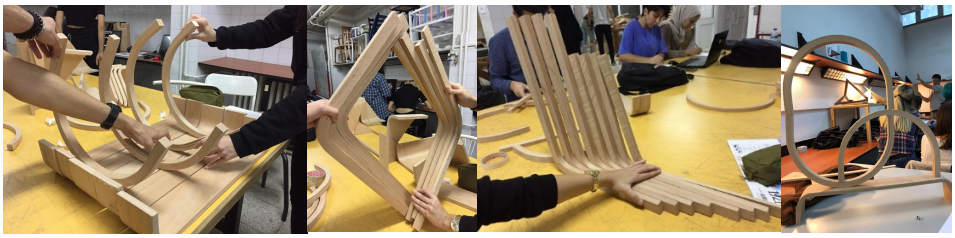

Figure 3: Students' mentions coded as "experiments for joinery"

The mentions (n=66) under title "Things that we have learnt" surprisingly have more mentions (n=19) than expected for power tools. Students mentioned power tools names and their specifications and explained how they work. Material knowledge is mentioned (n=10) as expected. Students also mentioned how they get familiarized (n=10) with residual pieces.

Some of the students' mentions are:

"We have seen how the CNC works and realized that how the sanding we have done was not enough."

"We have learnt that while choosing materials esthetics is not the only criteria we also must think about the cost. So, we can reduce cost just by changing the materials and we will still have the same appearance."

The title "Things that we have felt" is more positive than expected, students mentioned positively (n=39) nearly five times greater than negative (n=8). The most remarkable figure in negative mentions is the fear (n=7) that it is dominating the negative mentions. Because only one group have 5 mentions about fear it is evaluated as a bias.

Some of the students' mentions are:

"It was very exciting and pleasing to see our deign in production."

"We were faced with reality that because of the cost not every design can be realized so it made a group like us full of enthusiasm disappointed."

3.2. Analysis on Industry Survey

The questionnaire answered by KYS owner includes open ended and 5 grade likert scaled questions. Open ended questions were mostly about the unseen facts. The questions are answered honestly by respondent. The open-ended question about the time spent weekly for this collaboration was answered as 3 hours for the class and 1 hour for preparation to the class and for the production period 2 full days from morning till the afternoon. Respondent also mentioned that he has paid extra wage to workers for out of work hours. It was also mentioned that material supplies did not cost much to the company thanks to the use of residual material. But when residual pieces were not enough it was needed to prepare new pieces from production pieces. It was also mentioned that some disruption was occurred in ongoing production because of unprogrammed visits by students. At least 2 or 3 workers were reserved for students' productions.

The respondent answered questions about the reuse or recycle policy of the company. Company has already a vision about reuse of residual material in new products and it is said that these products are more profitable than their other products. But at the other hand these products are mostly one-off productions and need more workmanship. Other than reusing the cut residuals of wood profiles, polyurethane sponge and upholstery fabric residuals are reused. But the company does not have a vision for recycling for other residuals as sawdust and wood chips. It was told that they are used as fuel for winter and burnt in stoves.

KYS owner has been requested to answer questions in four diverse groups titled as University-industry collaboration, thoughts on students, personal thoughts, and thoughts on end-product design. From answers to questions about University-industry collaboration shows the respondent believes that this collaboration will continue and improve in the future and the identity of the University and being a tutor in the class is important for this collaboration but not more than personal relations with colleagues. From answers to questions about the students, it was understood that the respondent believes, students learnt a lot in this collaboration and they were motivated both in design and production phase, working in groups was useful in production phase. The respondent did not have a clear opinion about the cost of production for students and if working groups was efficient. He also was indecisive if the students are sufficient at design, but he believes that they are not sufficient at production. Answers for personal questions show that the class has confronted respondent's expectations. He believes that he has done a valuable work in this class. He mentioned he was contented in this class. He also believes that his vision to design improved but to production it cannot be said. The class was not difficult for him on timing or budget. Finally, he mentioned

that in consideration of the end-products, students' designs are better than he expected, and he found them original. But when it is asked if they are sufficient to be used in his company, he was indecisive

4. Discussion

Analysis made on student surveys, reports and industry survey indicate that expectations of University and Industry are mostly fulfilled. From student surveys it could be understood that students are happy with this collaboration. They mentioned in their reports that they have learnt more than they expected. The collaboration helped them to fill the gap between theoretical and practical knowledge. For this reason, it could be said that one of the expectations of University has been fulfilled. Students realized their ideas at the factory, but it was difficult for them to try out every idea they created because of logistics and ongoing work at the factory. For this reason, it could be said that the expectation of having the opportunity to use the workshop has been partially fulfilled. Students mentioned that they could not have enough material during production phase. But at the end all of them have realized their projects. It was assumed that it was a temporary lack of desired materials, because also KYS told they had to prepare new pieces from non-residual parts. Therefore, the expectation of lowering material cost has been fulfilled. At the other hand students mentioned the cost was too high for production and it was difficult to hold their budget. Some groups needed other materials like steel construction. This kind of production could not be done in KYS therefore students needed to make these in separate workshops in the periphery. That is why they needed to cover those expenses. Also, transportation of goods from KYS to the University was a mess and students needed cover expenses on their own. For this reason, it could be said that expectations of lowering costs was not fulfilled. Students are mostly happy with the associate professor. It could be understood from the higher ratios on likert scale and students' sayings in report. the expectation of employing a professional as an associate professor is fulfilled successfully.

From industry side expectations are mostly fulfilled as KYS liked the end-product designs and was happy with the collaboration. The owner was keen to continue the collaboration. Two students started their internship at KYS and after finishing the internship they started to work part-time.

More than the expectations of both sides the collaboration paved the way for students to think about reuse and recycle. A remarkable situation about the end-products is that most student groups found ideas about lighting. This finding could be helpful for KYS to which function they should focus on to reuse residual material in new design.

5. Conclusion

The collaboration was started for the needs of both sides and improved to an ongoing system where the industry representative became a part-time associate professor in University. Most of the expectations from this collaboration are fulfilled but some lessons are taken also. Some of these are evident but some are hidden in the process. To find out these hidden problems and find solution for them both sides of the collaboration must have passion to continue. Industry must think that University is not just the other side of the collaboration. University side is consisted of students and academics and both have different expectations. The combination of their expectations makes the expectations of the University. For this reason, it is important to improve contact with students as done with academics. Academics have the role of being a bridge between industry, students, and University administration. University – industry collaboration is a demanding act. If only one side is demanding the collaboration will be ineffective for both sides.

The collaboration which has been done in 2019 was focused on education and University is the most demanding side. Industry's demands were more abstract. This collaboration will continue to deal with Industry's more substantial needs but the collaboration on education will be continued.

6. Acknowledgments

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