

STUDENTS' WORK DIARIES: VISUAL IMPRESSIONS OF A PROJECT-BASED LEARNING MODULE

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ABSTRACT

The object of the present article is a summary of Students' Work Diaries, prepared by every team participating in the Project-Based Learning Module (PBLM) called *Design Project*, a study module of the *Engineering Design (Interior and Furniture Design)* Bachelor Program.

The following questions related to the diaries are considered in the article: Are students paying enough attention to these diaries as a tool to present their work? To what extent is the submitted information sincere and complete? Are students' work diaries an effective way of grading each students' teamwork and the individual members?

Based on the analysis made of students' diaries from *Design Project* module in four successive years, conclusions and recommendations are made. The aim is to improve the requirements for the preparation of student diaries, so that teachers can use them for grading the work done by teams and their individual members.

Key words: Team Project-Based Learning (TPBL), Design Education, Work Diaries.

INTRODUCTION

The topic of the Project-Based Learning Module (PBLM) called *Design Project (Project Week)*, held at the University of Forestry each year, and the methodology of the implementation has been repeatedly considered by the authors of this article (R. Raycheva et al., 2013; R. Raycheva et al. 2016; R. Raycheva et al.; D. Angelova et al., 2019). The authors studied and analyzed in detail the results of the surveys taken from students with the aim to reveal the benefit of Team Project-Based Learning (TPBL) in education and the psychological issues facing small groups (R. P. Raycheva et al., 2016). It can be seen even in the first article published on the subject (R. Raycheva et al., 2013), that the *sketchbook/diaries* the teams have to develop were a part of the mandatory visual materials that had been required to be presented by the students at the end of the PBLM. However, the content itself and its informativeness have

not been a subject of analysis by the authors. The question arises whether the individual team diaries can be included in the final teams evaluation, as well as individual members (self-monitoring and self-evaluation)? It is no less important to establish whether these diaries can be a part of self-regulated learning tools.

The researcher Tsai-Yun Mou used weekly student diaries in her study of 3D design online courses. The diaries included self-reporting questions with rating scales for the students to evaluate their own learning. The questions provide information on the students' self-assessment, regarding: weekly planned time; goal achievement and time management; self-report of attention focusing; students' weekly self-monitoring; students' weekly self-evaluation and ways to improve their learning. It was found that a structured diary was helpful for promoting self-regulated learning to a certain degree. (Mou, T.-Y., 2023).

Weekly student diaries were also quoted in the study by Huatian Wang, Jinxin Yang & Peikai Li, with the aim of goal-directed self-regulation, which in turn led to the improved psychological well-being of students. Similarly, these diaries contain a series of questions that collect not only basic information such as age, gender, tenure, education background, and our moderator variables (i.e., optimism and social support), but also questions that concern self-regulation behaviors, weekly academic performance, and weekly psychological well-being. Their results showed that: 1) goal-oriented self-regulation behaviors are positively related to psychological well-being through increasing academic performance; 2) optimism strengthens the indirect effect of goal-oriented self-regulation on psychological well-being; 3) social support is another important contextual factor of the indirect effect of goal-oriented self-regulation on psychological well-being. (Wang, H., Yang, J. & Li, P., 2022)

Yaron Doppelt (Doppelt, Y., 2009) studying pupils' performance during project-based learning, demonstrates adopting new assessment methods, such as portfolio assessment. Using this method, he reports in portfolios high-level documentation of the projects. Also, it is reported that other valuable information about documenting teamwork and pupils' reflection can be obtained.

A large percentage of projects in the field of design are evaluated when the final results of TPBL are presented in the form of an exhibition, and the effect of this exhibition will be the most important factor to when the evaluating staff assess their performance (Zhijuan Zhu et al 2019). The problem with this type of procedure is that it evaluates teamwork, while individual workload of each team member becomes relatively difficult for teachers to judge. The fact is that in a team there are almost always some students who

do less work. For educators participating in TPBL, it is extremely important to have tools to measure and evaluate both the performance of each member of the team and to obtain information about student self-assessment. Regarding the evaluation of the individual team members, there are several options and these are: observation and evaluation of each student during the work process (daily) and during the presentation of the projects (interim and final), as well as through surveys. In terms of self-assessment, the possibilities are almost the same, but this self-assessment is not always sufficiently objective. Therefore, it is necessary to look for other forms, which, however, should not take too much of the otherwise short time of 5 days to conduct TPBL.

The problem with assessment is reported in the study of James A Russell et al (2018), in which it is stated that frequent opportunities for formative self-assessment and revisions are paramount to a successful TPBL experience. "Instructors should provide opportunities for a detailed discussion of student progress and performance and give the opportunity for students to give feedback on both the problem and the instructor's performance; however, such detailed discussions are too time consuming to carry out on a frequent basis (perhaps only a midterm discussion and final wrap-up are possible). In order to provide more frequent opportunities for assessment, self-assessments and joint-peer assessments can be implemented." (Russell et al, 2018).

Many studies have adopted surveying as a method to assess TPBL (Rio and Rodriguez 2022; Berselli et al, 2020; Guo, P. et al., 2020). This assessment is more about student satisfaction with: the specific way of learning and teachers' work than self-assessment and teamwork assessment. Such an evaluation method was also adopted by the authors in

their work with the students of the Engineering Design (Interior and Furniture Design) Bachelor Program at the University of Forestry. The survey is carried out after the final presentation and immediately before the jury evaluation of the students' projects and the jury announcement of student team ranking. The surveys include questions that concern both the evaluation of the team and the staff work, as well as self-evaluation. However, it is also interesting to follow the feedback, presented in the diaries by each team.

Students participating in each PBLM receive written day-by-day instructions, clearly stating that each team must keep a "log" of the event. The diaries are usually assigned to a student from the team who is specifically selected for the purpose and presents it in its final form at the final presentation. The only restriction is that the diary must be in the form of a portfolio in A3 format. The instructions explain that the diary (by means of drawings, photographs, text and collages) should demonstrate the participants' experience day by day, revealing the origin and development of the idea, the reasoning of the problem and its solution. It clearly states that the diary has the role of self-evaluation for the team and its achievement for the past day. The diary should be kept according to journalistic rules, saying what, when and where happened. The staff in charge of the PBLM set no limits either in terms of volume or means of expression to be used in preparing this album. It is clear to all participants that given the limited time of five days (practically less), the elements of the overall presentation of the team and its work must be strictly distributed among the participants, for more operational work. It should be noted that the logs do not affect the final grades of the teams.

In this paper, students' diaries from the following Project-Based Learning Modules (PBLM) were reviewed:

- PBLM with 4-year students on the theme: "Elegant but Sturdy", held in the period 09.11-13.11.2015. The diaries of all eight participating teams were examined.
- PBLM with 4-year students on the topic: "Living in a Container", held in the period 27.11-01.12.2017. The diaries of all seven participating teams were reviewed.
- PBLM with 4-year students on the topic: "Knitting: from Clothing to Furniture", held in the period 12.11-16.11.2018. The diaries of all six participating teams were examined.
- PBLM with 4-year students on the topic: "Fantasy and Dynamics in the Workplace", held in the period 11.11-15.11.2019. The diaries of the seven participating teams were examined.

METHODS

Through observation and analysis, the quality of the back feed extracted from the student work diaries is researched. The authors are looking at whether this information could actually be useful for grading the team and each individual member. Every single one of a total of 27 students' diaries has been analyzed based on the photographic material and text provided. The total volume of pages, the presentation of the team's experience by days, the analysis and evaluation of the development of the idea, the argumentation of the problem and the solutions were considered.

The authors have asked themselves these questions: "How much of the required information is supplied? How was it pre-

sented (was there balance between photographic material and text)? To what extent can additional information be extracted in terms of: Educational module; The working environment of the event; Work and relations in the team; The performance of the teachers; The role of the leading designer.

This information is provided in a tabular way for every single one of the four educational modules. A scale was prepared to help grading the results. The summarized and analyzed data are used to draw conclusions of important pedagogical value.

RESULTS

Analysis of the student diaries reveals if and how the students followed the instructions given to them in written format by the lecturers for correctly keeping the diaries (Fig.1÷2). Data is provided for each of the set criteria in tabular form, while at the same time the required information is evaluated,

using a methodology compiled for the purpose, which reflects how well the content is presented according to the individual criteria.

Rating scale of required information: *Very good ratio of photo to text material* – the photo material and the text complement each other and present the content perfectly; *Good ratio of image to text material* – image material and text complement each other and present the content well; *Satisfactory* – at certain moments photographic material or text is lacking, therefore they do not fully clarify the content; *Dissatisfactory* – the presented diaries lack photographic material or text for the most part, which does not fully clarify the content; *Bad – Poor image to text ratio* – not enough images or text to make the content comprehensible. The analysis of the logs in terms of the required information is presented in tabular form (Tables 1÷4).

Table 1: Analysis of the information from PBLM with 4-year students on the theme: “Elegant but Sturdy”, held in the period 09.11-13.11.2015. The diaries of all eight participating teams were examined. Teams of students were formed by random choice.

Team	Total page volume	Required information			Additional information: Attitude towards:
		Presentation of teamwork by days	Analysis and evaluation of the development of the idea	The argumentation of the problem and its solution	<ul style="list-style-type: none"> • Role of the lead designer • Performance of teachers • Team relationships • Work environment • Study module
Team 1	7	Very good	Very good	Good	There is no comment
Team 2	8	Very good	Good	Missing	A brief opinion regarding team relationships, the work of teachers and the role of the lead designer.
Team 3	10	Very good	Very good	Very good	A detailed attitude to the study module, to the work of the teachers and the relationships within the team.
Team 4	6	Bad	Missing	Missing	There is no comment
Team 5	19	Very good	Very good	Very good	Opinion expressed regarding team relationships.
Team 6	9	Dissatisfactory	Good	Bad	Opinion expressed regarding team relationships.
Team 7	61	Bad	Bad	Missing	A brief opinion regarding team relationships.
Team 8	14	Satisfactory	Missing	Missing	A brief opinion regarding team relationships.



Figure 1: Diary on Team 3, PBLM with 4-year students on the theme: “Elegant but Sturdy”

Table 2: PBLM with 4-year students on the topic: “Living in a Container”, held in the period 27.11 – 01.12.2017. The diaries of the seven participating teams were reviewed. Teams of students were formed randomly.

Team	Total page volume	Required information			Additional information:
		Presentation of teamwork by days	Analysis and evaluation of the development of the idea	The argumentation of the problem and its solution	Attitude towards:
Team 1	20	Bad	Missing	Missing	• Role of the lead designer • Performance of teachers • Team relationships • Work environment • Study module A brief opinion regarding team relationships.
Team 2	6	Satisfactory	Missing	Missing	A brief opinion regarding team relationships.
Team 3	8	Very good	Very good	Very good	A detailed attitude to the study module and brief opinion regarding the relationships within the team.
Team 4	9	Very good	Missing	Missing	A brief opinion regarding the work of teachers.
Team 5	8	Good	Missing	Missing	Opinion expressed regarding team relationships and learning module.
Team 6	6	Dissatisfactory	Missing	Missing	There is no comment

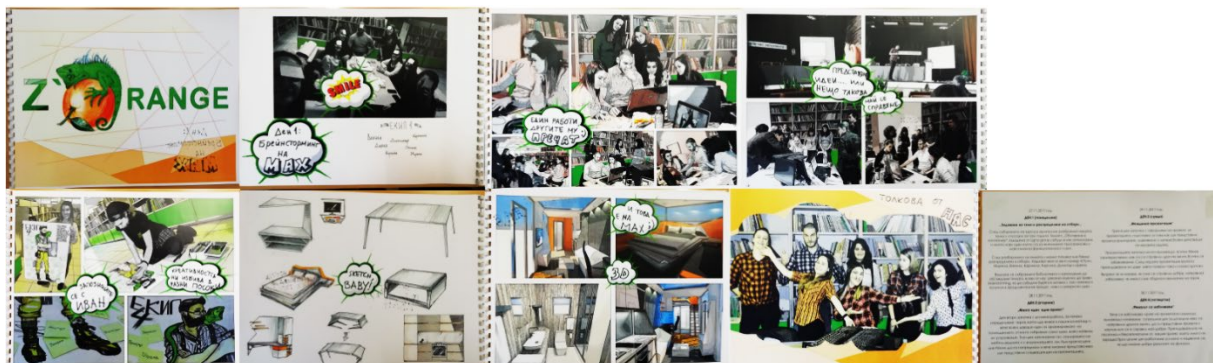


Figure 2: Diary on Team 4, PBLM with 4-year students on the topic: “Living in a Container”

Table 3: PBLM with 4-year students on the topic: “Knitting: from Clothing to Furniture”, held in the period 12.11-16.11.2018. The diaries of all six participating teams were examined. Teams of students are formed randomly.

Team	Total page volume	Required information			Additional information: Attitude towards:
		Presentation of teamwork by days	Analysis and evaluation of the development of the idea	The argumentation of the problem and its solution	<ul style="list-style-type: none"> • Role of the lead designer • Performance of teachers • Team relationships • Work environment • Study module
Team 1	7	Good	Good	Missing	There is no comment
Team 2	14	Good	Missing	Missing	A brief opinion regarding team relationships and the working environment.
Team 3	11	Very good	Very good	Missing	A brief opinion regarding team relationships, the learning module and the role of the lead designer.
Team 4	11	Good	Very good	Satisfactory	There is no comment
Team 5	7	Good	Good	Missing	Opinion expressed regarding team relationships.
Team 6	7	Very good	Very good	Good	A brief opinion regarding team relations, the environment and the role of the lead designer and teachers.

Table 4: PBLM with 4-year students on the topic: “Fantasy and Dynamics in the Workplace”, held in the period 11.11-15.11.2019. The diaries of all seven participating teams were examined. The students chose their teams by themselves.

Team	Total page volume	Required information			Additional information: Attitude towards:
		Presentation of teamwork by days	Analysis and evaluation of the development of the idea	The argumentation of the problem and its solution	<ul style="list-style-type: none"> • Role of the lead designer • Performance of teachers • Team relationships • Work environment • Study module
Team 1	8	Very good	Good	Bad	Opinion expressed regarding team relationships, learning module and work of teachers.
Team 2	7	Very good	Bad	Missing	Opinion expressed regarding the environment.
Team 3	6	Bad	Bad	Missing	There is no comment
Team 4	10	Bad	Missing	Missing	A brief opinion regarding team relationships.
Team 5	10	Good	Good	Missing	There is no comment
Team 6	11	Very good	Very good	Good	A brief opinion regarding team relationships and the working environment.
Team 7	11	Very good	Very good	Satisfactory	A brief opinion regarding team relationships and the working environment.

In 62.9% of the diaries, the number of pages is 6, 7, 8, 10 and 11 (Fig.3). In 14.8 % of the diary's volume is 9 and 14 pages. There are also small exceptions when a larger page volume is submitted, but in these cases there

is not always a noticeable improvement in the quality and quantity of feed back provided. In one of these cases – 61 pages. It does not follow that the format and requirements are

complied with – the diary was in the format B5.

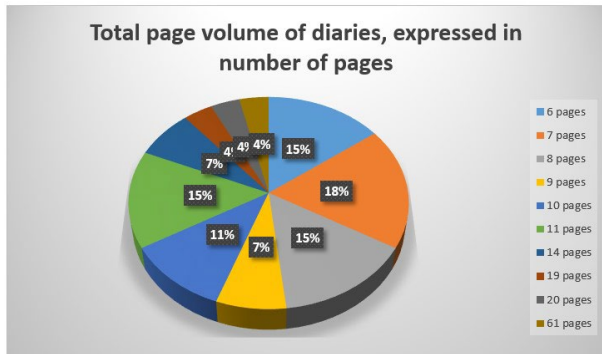


Figure 3: Total page volume of diaries, expressed in number of pages

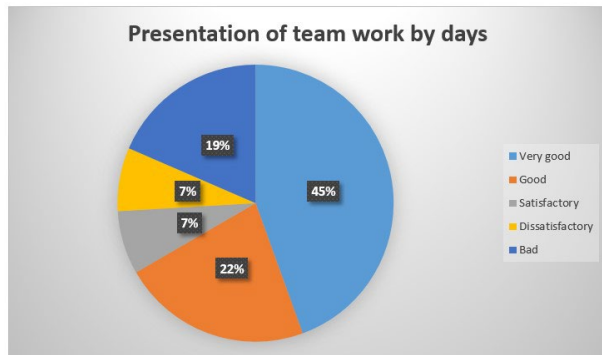


Figure 4: Presentation of teamwork by days (ratio of images to text content)

In 44.5% of student diaries, a “*Very good*” performance on teamwork during the day can be observed, which proves that students do not experience such great difficulty in this regard (Fig.4).

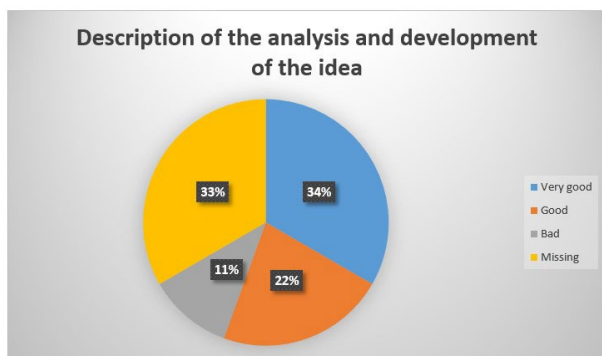


Figure 5: Results regarding the description of the analysis and development of the idea

When analyzing the diaries with respect to the description of the emergence and development of the idea, the results are at both extremes (Fig. 5). “*Very good*” description is found in 34% of diaries, but in the same percentage of diaries (33%), such description is completely missing. The reason for this has to be found. Perhaps the answer lies in the lack of time or difficulty with the description (from the viewpoint of expression, not knowing where to start, etc.), neglecting the work of the diary, because these are not part of the final assessment.

Even worse are the results from another teacher-regulated requirement – reasoning on the problem and its solution. In about 63% of the submitted diaries, such information is completely missing, and in 37% of them, it is good, satisfactory and poor. The reasons for this could again be the same as the ones presented above.

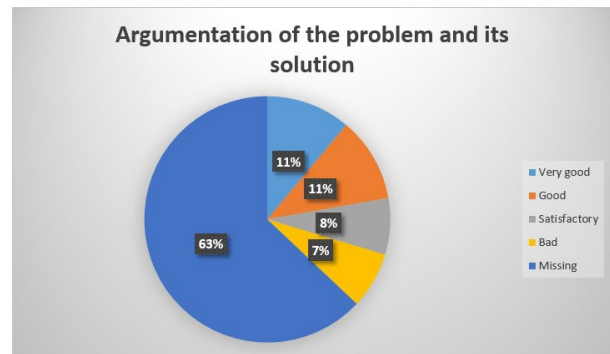


Figure 6: Results regarding the argumentation of the problem and its solution

Although it is clearly stated that the diary has a self-evaluation role for the team and its work, this is very rarely seen. Only in one of the 27 diaries, numerical evaluation can be seen and not even for every day. One of the reasons for gaps in mandatory feedback may be due to insufficient emphasis on diaries work by the teachers.

Of particular interest to us is the additional feedback that can be obtained from student diaries. 26% (or 7 diaries) of them lack

such information. In 22.2% of them (six diaries), an opinion was expressed on two topics. Three diaries (11.1%) expressed an attitude on three topics, and only one diary touched on four topics. Most of the additional information concerns team relations: team relations; which teams were able to get along and work together and which were not; moods of team members and their impact on teamwork; the emotions they go through; the distribution of work among team members; the attendance of members and especially their tardiness; how long the team (individual members of it) remains working after the specified time; the presence of a leader/leaders in the team.

In two of the diaries, a written evaluation made by another team on the interim presentation was submitted. In addition, in one of them, an assessment and intentions to improve the future final presentation are given to it.

The attitude towards the role of the leading designer and teacher performance is poorly represented. In half of the comments made, a positive attitude and influence of their guidance on the work of the team can be observed: *“The designer Ilian Malinov presented some of his product designs and tried to help students by answering questions in detail and comprehensively.”*; *“After the visit of the lead designer – Ilian Milinov and the team of teachers, even more ideas came up”*. The remaining part reflects the criticisms made and their result on teamwork: *“During the teachers’ visits, our product was ridiculed and rejected, and a feeling of failure arose in us”*; *“We were neither encouraged nor criticized, perhaps we expected a bit of both.”*; *“After our presentation, the tutor group gave both praise and some criticism”*.

It is visible that students are prepared for the PBLM: *“Unlike last year, this Project*

Week we knew what was coming. We had allocated the project tasks in advance and were doing reasonably well for the time we had.” In two of the diaries, students not only like, but also prefer this type of learning: *“The long-awaited project week has finally begun”*; *“The time has come for the long-awaited Project Week. Second and last in a row. ...We knew the steps to follow and started piling up problems and solutions in the Brainstorming phase”*.

Five teams in their diaries demonstrated the attitude towards the learning module. All comments on this issue can be defined as positive, regarding the PBLM: *“The Project Week was a new experience, with its positive and negative sides. The real live conditions provided important information and experience that would be useful to us professionally. Working with different people is part of our field of work, that's why I think that any experience in this direction is extremely useful and important”*; *“The experience was rather positive and certainly useful!”*; *“This week has motivated me to keep fighting to reach my desired goal”*; *“Overall a positive experience”*; *“This is probably the best week of the semester.”*; *“We consider the time of the project week to be completely fruitful in every single paragraph”*; *“During this week we learned to listen, understand, compromise, do teamwork and to prepare for our future work in this field. The most important thing is the experience we gain working with randomly selected colleagues. These things help us and teach us how to work in a real live environment.”*; *“We discussed how useful Project Week is for us and we are grateful that it is in the program.”* etc.

In five of the diaries, an attitude towards the work environment in which the teams are located is also expressed. The comments mainly focused on the furniture, or rather the lack of it: *“As future designers, we had to*

face an interior problem on the very first day, that being an empty room – no desks, chairs, we only had a lot of electrical outlets. Moving desks, chairs and after that was done – we were settled at our working places” and to the temperature in the premises: “Day 2, 9:00. Early morning, we arrived fresh. Ice Age 6. Everyone warms up as best as they can... polar bears’ fight in the room. Allegedly, they turned on the heating ... but “allegedly” for an hour. And this heater, how warm... G. starts knitting blankets for everyone... I hope we have enough yarn left by Friday”; “Day 1: “Later, the whole team and I head to room 504, where miracles will happen. But it's so cold here that when we hear knitting work, we think of a sweater and a hat and dream of resting in front of the fireplace in some warm cabin.”

The deployment of several teams in one room was also referred to as problematic: *“From the very beginning, a problem arises. We are 3 teams in one room and there are not enough desks... and we need to talk more quietly, look at each other”.*

DISCUSSION

From the analyzed results, it can be concluded that the diaries presented in this way cannot be used to evaluate the students, either individually or as a team. This evaluation is appropriate when the following conditions are met: 1) when the work on the logs begins to be evaluated with marks and the evaluation is considered in the final grading of the project; 2) when adding clearly stated questions for students to answer.

This begs the question: Do we really want the diaries to serve as a grading device, and will this not lead to the loss of the students' candid (intuitive) approach to compiling these diaries? We must not forget that one of the team members is usually responsible for the compiling of the diary, which means

that the result is the work of only one person's subjective reflexes, his attitude to teamwork, his attitude to the PBLM, etc. Therefore, to have a more accurate evaluation of the team and individual work of the students, the evaluation questions should appear in the surveys that each student completes before the final grading and ranking of the teams and the announcement of the winner. At the same time, these polls are anonymous and in them students can express their opinion sincerely, while in their diaries, the opinion is visible, and everyone must stand behind it with their name or on behalf of the team.

Unlike surveys, where the teaching team formulates the questions, the feedback in the diaries, which is not defined as mandatory, is distinguished by its casualness. However, do students pay enough attention to these diaries as a means of presenting their work? Rather not. This conclusion can be made based on the relatively unsatisfactory results regarding the description of the emergence and development of the idea, as well as the argumentation of the problem and its solution (both are part of the required information). This also answers part of the question posed at the beginning: How sincere and complete is the information provided? From the analysis of the 27 diaries, it can be seen that the submitted feedback is definitely not complete. We can categorically state this from the position of the teaching team, which for 5 days, from morning to evening, tries to cover all the student teams with advice, criticism and ideas. The main problem here is that, in fact, very often diaries were made "after the facts", and not really “day by day”, and for this reason there was a lack of argumentation, because it was simply forgotten, and the aim was only to fulfill the minimum requirement – i.e., to submit a diary. Of course, other reasons can be mentioned, such as lack of time; difficul-

ties with the description (in terms of speaking, not knowing where to start, etc.), neglecting the work on the journals, because they do not represent a part in final assessment, etc.

Is this format of the logs still appropriate and does it carry the necessary feedback?

The student diaries clearly showed the quality of the design process in each team, although we must admit that this usually (but not necessarily) was observed in teams that 'succeeded' in the task. So, what do we care about the diaries of the 'failing' teams if they were badly done? Even this question is good to try to answer. For example: sharp disagreements, arguments, fights, lack of motivation, lack of discipline, delays that hinder teamwork and basically, refusal to generate ideas. If there was a 'leader' and an 'anti-leader', was this information clear from the logs of the failed teams? What the teaching team remembered about a given student team also played a role here. We have a clear example of how winning teams do not always describe their ideas well – the winning team of the project week on the topic: “Knitting: from Clothing to Furniture” submitted a very concise diary!

If, for the sake of clarity, we divide all teams into two groups: successful and unsuccessful ones, then the feedback on success is more visible than feedback on failure. We could even say that feedback on failure is obvious in the lack of information and negative attitude to the overall event. We observe rejection as a reaction. Are students prone to introspection? Some yes, some no, depends on the success of the venture.

However, if we want specific responses to certain important moments of the PBLM to be reflected in the diaries in future, we need to have very clear instructions prepared. These instructions can take the form of explicitly formulated questions regarding the

role of the lead designer; the teacher's performance; team relations; work environment, and the learning module as a whole.

CONCLUSION

Despite the often incomplete and unstructured content of the diaries, they remain a valuable source of feedback on the students' impressions of everything happening during the design event, as well as an indication of the interpersonal relations, both within the team itself and with the teachers.

Unfortunately, the introspection we could expect to find in the diaries is almost entirely absent. Students are reluctant to self-analyse their individual or teamwork.

However, the students' diaries produced during PBLM can help to evaluate the work of the team or staff, to draw important conclusions about the methodology of each learning module.

All diaries have one thing in common – they all end with positive emotions generated by the experience, with pride in what has been done and with well-deserved self-confidence from the evaluation of teachers and sponsors. Regardless of the final ranking.

REFERENCES

- ANGELOVA D., R. RAYCHEVA, R. CHIPEV. 2019. Student Workshop: Creativity in Progress. Proceedings of International Conference “Wood Science and Engineering in the Third Millennium” – ICWSE 2019, 7–9 November, 2019, Transilvania University, Brasov, Romania, Volume 2, ISSN 1843–2689, pp.549–557.
- BALDISSERA, P., DELPRETE, C. 2020. From PBL to innovation: a decennial case-study from an HPV student team. *Journal of Engineering, Design and Technology*, Vol. 18 No. 4, pp. 773–786, <https://doi.org/10.1108/JEDT-01-2019-0005>.
- BERSELLI, G., BILANCIA, P. & LUZI, L. 2020. Project-based learning of advanced CAD/CAE tools in engineering education. *Int J Interact Des Manuf* 14, 1071–1083, <https://doi.org/10.1007/s12008-020-00687-4>.

- DOPPELT, Y. 2009. Assessing creative thinking in design-based learning. *Int J Technol Des Educ*, 19, 55–65, <https://doi.org/10.1007/s10798-006-9008-y>.
- GUO, P.; SAAB, N.; POST, L.S.; ADMIRAAL, W. DATE. 2020. A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research*, Volume 102, 101586, ISSN 0883-0355, <https://doi.org/10.1016/j.ijer.2020.101586>.
- MOU, T.-Y. 2023. Online learning in the time of the COVID-19 crisis: Implications for the self-regulated learning of university design students. *Active Learning in Higher Education*, 24(2), 185–205. <https://doi.org/10.1177/14697874211051226>.
- RAYCHEVA R., V. JIVKOV, D. ANGELOVA, P. VODENOVA. 2013. Design Workshop for Students. In *Proceedings of Third International Conference "Education, Science, Innovations" ESI'2013*, Pernik, DOI: 10.13140/2.1.3076.7680, p.90.
- RAYCHEVA R, V. JIVKOV, D. ANGELOVA, P. VODENOVA. 2016. Study Module "Project Week": Through the Eyes of Students. *Innovations in Woodworking Industry and Engineering Design*, Vol.5, 1/2016, ISSN 1314-6149, pp.46-53.
- RAYCHEVA, R, D. ANGELOVA, P. VODENOVA. 2016. Project-based learning in engineering design in Bulgaria: expectations, experiments and results. *European Journal of Engineering Education*, Taylor & Francis Online, October 2016, Pages 1–18, ISSN: 1469-5898 (online), DOI: 10.1080/03043797.2016.1235140 available at: <http://www.tandfonline.com/doi/full/10.1080/03043797.2016.1235140>.
- RIO, TGD and RODRIGUEZ, J. 2022. Design and assessment of a project-based learning in a laboratory for integrating knowledge and improving engineering design skills. *Education for Chemical Engineers*, Volume 40, July 2022, Pages 17–28.
- WANG, H., YANG, J. & LI, P. 2022. How and when goal-oriented self-regulation improves college students' well-being: A weekly diary study. *Curr Psychol* 41, 7532–7543. <https://doi.org/10.1007/s12144-020-01288-w>.
- RUSSELL, A., HELMS, R., EVERHART, C., MILLER, J. 2018. Applying Project Based Learning in an Undergraduate Design and Construction Program at Appalachian State University. *Journal of Green Building*, 13 (4): 147–165. <https://doi.org/10.3992/1943-4618.13.4.147>.
- ZHU, ZJ., CAO, H., CHEN, X., LONG, R. 2019. Enlightenment of Design Education in Purdue University: Research and Practice on Assessment Method in Project-Based Learning of Industrial Design Discipline. *IOP Conf. Ser.: Mater. Sci. Eng.* 573 012001.



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